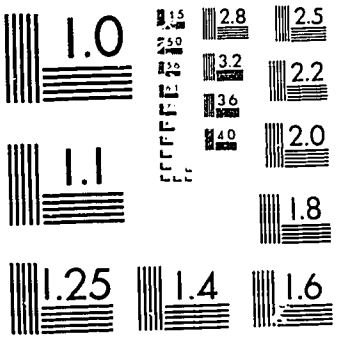

DOCUMENT RESUME

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IDENTIFIERS	*OBIS Program; Outdoor Biology Instructional Series

ABSTRACT

The 24 activities in the Outdoor Biology Instructional Strategies (OBIS) Trial Edition Set II use living organisms such as crabs, birds, crayfish, lichens, and insects to investigate biological interrelationships, organism behavior, and species density to promote greater environmental and sensory awareness. The activities, designed primarily for groups of children ages 10 to 15, focus on terrestrial, beach, freshwater, marine, woodland, and other habitats. Light and its effect on animal behavior, study of intertidal plant and animal colonies, hibernation site study, comparison of insects in lawn areas and weedy areas, a simulated oil spill, investigation of sea movements and currents, and a series of environmental games are among the specific activities. Each is presented in a folio with an introduction, list of materials, action, discussion, and follow up. There are three additional folios: (1) an introduction to OBIS: (2) a "Leader's Survival Kit", with suggestions for the combination of the Set I and II activities into various learning modules organized by biological or environmental concept, skill, or habitat; and (3) an OBIS Tool Box, containing Equipment and Technique Cards with instructions for the construction and use of inexpensive equipment, such as bird feeders and tide stakes. (SB)

OUTDOOR BIOLOGY INSTRUCTIONAL STRATEGIES
TRIAL EDITION

SET II

No. 901 G.

WHAT IS OBIS?

Outdoor Biology Instructional Strategies (OBIS) provides learning strategies for youngsters in the out-of-doors. Through activities that are both fun and challenging, OBIS offers investigations for ten- to fifteen-year-old youngsters in man-managed environments such as city lots, local parks, or neighborhood streams and ponds. These activities may be used independently or sequenced to tailor a program to suit your needs.

OBIS activities are prepared for community-sponsored youth organizations. Scouts, service groups, nature centers, and summer camps can all use OBIS activities in their environmental programs. These activities will help youngsters and leaders to better understand and appreciate environmental and ecological relationships.

WHY OBIS?

Our relationship with our environment has reached a crisis. For too long we have considered ourselves independent of nature; we have taken what we wanted and changed what did not suit our purposes. The environment withstood our carelessness for centuries because land was plentiful and our population was small. As man prospered, medicine and technology produced a greater chance of survival; and as our population increased, we demanded more of our earth's natural resources. Unfortunately, we remained uninformed or indifferent to the effects of our demands on plants, animals, soil, air, and water. We have now reached the point where we can no longer ignore the ecosystem of which we are a part. We now realize that we are exhausting the available supply of many natural resources.

If we are to make intelligent decisions regarding the future of our ecosystem, we must have a thorough understanding of basic biological relationships. The ecological understanding that grows with each OBIS experience will provide a base that youngsters can use in the future to more intelligently consider environmental and ecological decisions. This is the long-term goal of OBIS.

IT'S A BIOLOGICAL WORLD

We are part of the **ecosystem**, which includes living organisms and the non-living environment. Plants and animals, and their interactions with each other and their environment, all affect the ecosystem in some way. The study of these interactions between organisms and their environments is call **ecology**.

Food Chain

Energy for the operation of the ecosystem comes from the sun. Through **photosynthesis**, plants transform the sun's light energy into food energy. Animals cannot make food; they must obtain their food by eating plants or other animals that eat plants. The energy in the food is transferred from plants to plant eaters and then to animal eaters. This transfer is called a **food chain**. When organisms die, their bodies may be eaten by scavengers as diverse as worms and vultures.

Natural Recycling

Plant and animal tissues not eaten by scavengers are consumed by fungi, molds, bacteria, and many kinds of small animals. In the process of obtaining food, these organisms decompose the dead organic matter and eventually reduce it to minerals, water, and carbon dioxide. These materials, returned to the earth, water, and atmosphere, can then be used again by plants to produce food.

Community

Each group of organisms of the same kind that lives and reproduces in a particular area is a **population**. Populations of plants, of plant eaters, of scavengers, and of molds and bacteria live together and depend on each other for food and protection. Such a combination of interdependent populations is called a **community**.

Communities differ depending on their locations. A pond community lives in a pond and consists of different kinds of plants and animals adapted for living in a pond. Oceans, tidepools, lakes, streams, prairies, deserts, and forests all represent communities that differ according to the physical surroundings (**environment**) in which they live, and the populations of plants and animals that make up the community. The lawn that surrounds your house is a community as is the city park or vacant lot. You do not have to travel long distances into the "wilds" to find natural communities.

Life Cycle

Every species must reproduce in order to perpetuate its kind. The process by which an organism comes into being, grows and matures, and produces eggs, seeds, or their equivalent, which in turn become young organisms to repeat the pattern, is called the **life cycle**. Some life cycles are simple; some complex. Some life cycles are short, as in the case of a mosquito which may go through its life cycle in a matter of a few days, while others are long, as in the case of some trees that may take years to mature sufficiently to reproduce.

Adaptation

Within the ecosystem there are other organizing concepts and interactions that are universal wherever there is life. **Adaptations** are special features or behaviors that improve an organism's chances of surviving and reproducing in a particular environment. Some animals display color adaptations that allow them to blend into their surroundings, thus avoiding capture. Other adaptations improve the ability of plants and animals to secure food, reproduce, move through their habitat, and defend themselves. The adaptations that an organism possesses enable it to survive in certain environments. An animal that is adapted to extract oxygen from water, has fins for maneuvering, and can tolerate relatively warm water, might be expected to live in a shallow pond habitat. A **habitat** is the place where an organism normally lives and where you would ordinarily go to find it. A plant that can withstand high temperatures and low moisture might be found in a desert habitat.

If a habitat undergoes a radical change as a result of natural catastrophe (flood, fire, landslide, drought) or the intervention of man (land clearing, swamp draining, construction), the new environmental conditions may no longer support the varieties of life that were previously present. Some plants and animals that existed in the old environment may already have adaptations for the emerging environment, and may flourish. Organisms previously unable to live in a certain habitat may now colonize it because the environment of that habitat has changed. These first colonizers may not be adapted to compete with some of the organisms that follow later, may fail, and therefore may be replaced by still other organisms.

Man

One organism that influences every community is man. The advanced abilities of man's brain have contributed to technological advances that enable him to survive in a wider range of environments than other organisms and to gain dominance over many other life forms. With man's special abilities, however, he must assume responsibility for the consequences of his actions.

It is clear that the time has come for worldwide adoption of sensible management practices which can come only after an understanding of the ecosystem. OBIS provides one avenue for young people to approach this understanding.

WHAT IS OBIS?

ACA/OBIS

OUTDOOR BIOLOGY INSTRUCTIONAL STRATEGIES

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Outdoor Biology Instructional Strategies
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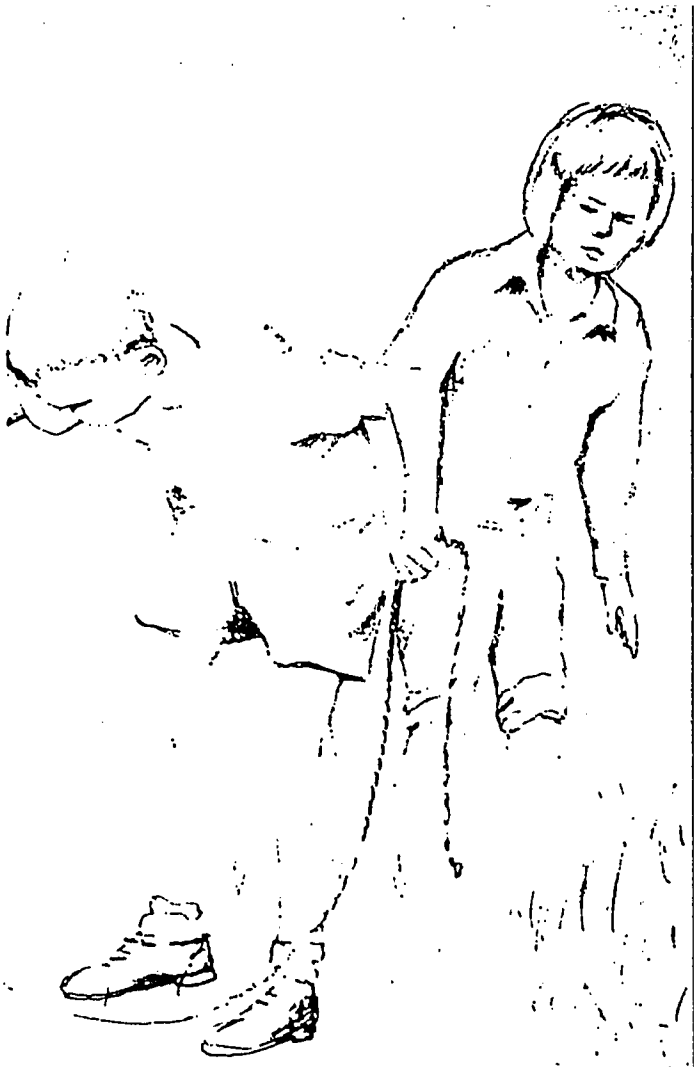
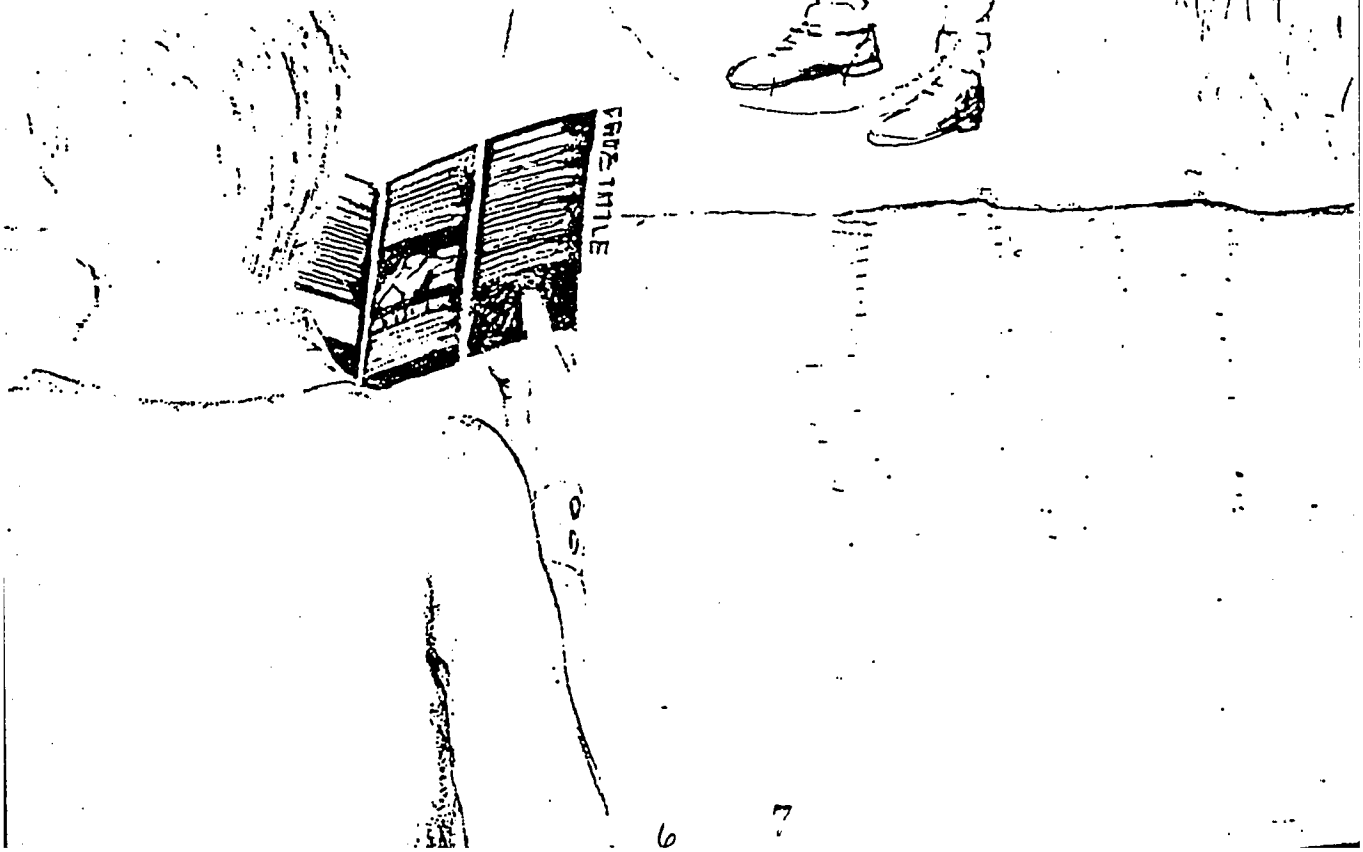
USING THE OBIS FOLIOS

OBIS activities are intended primarily for youngsters between the ages of ten and fifteen, but have been used successfully with both older and younger individuals, including family groups. With some assistance, mature youngsters can lead the activities for small groups.

Each OBIS folio can provide an enjoyable and interesting outdoor activity. You can either select individual folios for inclusion in your existing environmental program, or group a number of folios to provide a broader experience in outdoor biology. You are best suited to determine and meet the needs of your group on your site.

Look at the section entitled "Currently Available OBIS Folios." You will find a list of all the activities in **OBIS Trial Edition Set II** and the habitats in which each activity works best. If you also have **OBIS Trial Edition Set I,** various combinations of the 48 activities from the two sets will improve your ability to tailor the program to the needs of your participants.





CURRENTLY AVAILABLE OBIS FOLIOS

OBIS TRIAL EDITION SET I

Adaptation – Predator-Prey (All habitats)
Animal Movement in Water (Aquatic habitats)
Animals in a Grassland (Lawns, meadows, and fields)
Attention! (All habitats)
Bean Bugs (Terrestrial habitats)
Great Streamboat Race (Streams)
Habitat Sun Prints (All habitats)
Habitats of the Pond (Ponds and lakes)
How Many Organisms Live Here? (Ponds and lakes)
Invent an Animal (All habitats)
Invent a Plant (All habitats)
Mapping a Study Site (All habitats)
Moisture Makers (Terrestrial habitats)
Natural Recycling in Soil (Terrestrial habitats)
Natural Recycling in Water (Aquatic habitats)
Out of Control (Lawn)
Plant Hunt (Terrestrial habitats)
Plants Around a Building (Building sites)
Seed Dispersal (All habitats)
Sticklers (Terrestrial habitats)
Terrestrial Hi-Lo Hunt (Terrestrial habitats)
Water Holes to Mini-Ponds (All habitats)
What Lives Here? (Aquatic habitats)
Who Goes There? (Terrestrial habitats)

THE OBIS TRAIL MODULE

Trail Impact Study
Cardiac Hill
Hold a Hill!
Trail Construction

OBIS TRIAL EDITION SET II

A Better Fly Trap (Terrestrial habitats)
Animal Anti-Freeze (Cold terrestrial habitats)
Animal Diversity (Terrestrial habitats)
Attract a Fish (Freshwater habitats)
Beach Zonation (Marine habitats)
Birdfeeder (Terrestrial habitats)
Crawdad Grab (Marine or freshwater habitats)
Flocking to Food (Marsh or beach habitats)
Food Chain Game (Lawn or field habitats)
Gaming in the Outdoors (Terrestrial habitats)
Hopper Circus (Beach or field habitats)
Lichen Looking (Terrestrial habitats)
Litter Critters (Woodland habitats)
Metric Capers (Anywhere)
OBIS Oil Spill (Marine or freshwater habitats)
Plant Patterns (Terrestrial habitats)
Rock Pioneers (Rocky beach habitats)
Roots and Shoots (Terrestrial habitats)
Seas in Motion (Sandy beach habitats)
Sensory Hi-Lo Hunt (Terrestrial habitats)
Sound Off! (Lawn or field habitats)
The Old White Sheet Trick (Terrestrial habitats, at night)
Too Many Mosquitoes (Freshwater pond habitats)
Water Breathers (Marine or freshwater habitats)

ACA/OBIS CAMP KIT FOLIOS

Adaptation – Predator-Prey (All habitats)
Animal Diversity (Terrestrial habitats)
Animal Movement in Water (Aquatic habitats)
Attention! (All habitats)
Attract a Fish (Freshwater habitats)
Food Chain Game (Lawn or field habitats)
Gaming in the Outdoors (Terrestrial habitats)
Great Streamboat Race (Streams)
Habitat Sun Prints (All habitats)
Habitats of the Pond (Ponds and lakes)
Hopper Circus (Beach or field habitats)
How Many Organisms Live Here? (Ponds and lakes)
Invent an Animal (All habitats)
Invent a Plant (All habitats)
Lichen Looking (Terrestrial habitats)
Litter Critters (Woodland habitats)
Mapping a Study Site (All habitats)
OBIS Oil Spill (Marine or freshwater habitats)
Seed Dispersal (All habitats)
Sensory Hi-Lo Hunt (Terrestrial habitats)
Sound Off! (Lawn or field habitats)
The Old White Sheet Trick (Terrestrial habitats, at night)
Water Breathers (Marine or freshwater habitats)
Who Goes There? (Terrestrial habitats)

The folios included in this camp kit were not revised for this special printing. Some of the folio titles suggested in the **WHAT TO DO NEXT** sections will not necessarily be found in this selection.

OBIS MODULES

The OBIS folios may be combined to produce concept packages, skill units, environment-oriented clusters, and many other schemes according to the needs of the children or the judgment of the leader. Any such grouping is often referred to as a **module**.

The OBIS folios in this packet have been selected to form four ACA/OBIS modules. The modules are consistent with the four basic areas of understanding identified by the ACA Camp Ecologist Training Program. Refer to the "ACA/OBIS CAMP KIT" card in this packet for suggested folios for each module.

ORDERING ADDITIONAL MATERIALS

OBIS Trial Editions Set I and Set II, plus The OBIS Trail Module, are available from the Lawrence Hall of Science. See the "OBIS Order Form" in the *OBIS Toolbox* folio. Also see the "January 1976 Equipment Order Form" in the same folio if you wish to order equipment.

SAFETY

The safety of your group is a prime consideration. In order to assure safety, OBIS designs equipment and procedures to be as safe as possible. In addition, OBIS recommends that leaders organize a "Buddy Safety System" when participants explore any aquatic or other potentially hazardous site.

The buddy safety system is designed so that no participant will ever be far from assistance should it be needed. Group members choose a "buddy" they would like to work with. For an odd-numbered group, organize one team of three buddies. When the youngsters are paired off, tell them that each individual is responsible at all times for the whereabouts and safety of his buddy. A participant should never leave his buddy unless his own safety is threatened. In the event of an accident to one buddy, the other should render assistance and call for help.

LEADER'S SURVIVAL KIT ACA/OBIS

Avoid sites with obvious hazards such as steep banks and slide areas. Try to find a site with gently sloping banks for easy water access and unobstructed vision for easy supervision.

CONSERVATION — TAKE 'EM BACK ALIVE

Your youngsters should understand that no organisms should be permanently removed from their habitats. OBIS users collect organisms temporarily for observation and investigation, but all should be returned to the exact place they were found. (Leaf samples are an occasional exception.) The overall impact of your group on an activity site should be minimal. Setting some rules of procedure would emphasize respect for the activity-site environment.

SITE SELECTION

Make sure your selected site is large enough for everyone to investigate without interference, but small enough to allow easy supervision of the group. Site boundaries should be clearly marked and the participants kept within the boundaries. An area fifty meters square is ample for most activities, while some activities can take place in even smaller sites.

Secure permission to use a site in advance if such permission is required. Familiarize yourself with any rules or procedures that apply to the use of the site. Some sites, particularly public nature areas, are protected by strict rules, particularly rules regarding interference with living organisms. Make sure the youngsters understand and follow the rules.

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EQUIPMENT AND TECHNIQUE CARDS

You will find an assortment of equipment and technique cards inserted in this folio. These cards give you instructions for building and using various pieces of equipment required for certain activities. A few of these cards may be used in more than one activity. Additional copies can be made of any of the cards. Listed below are the activities that require these equipment and technique cards.

Animal Diversity
Sweepnet

Beach Zonation
Determining High Tide Level
Use of the Tide Table

Birdfeeder
Basic Birdfeeder
Bird Model
Eyespot

Flocking to Food
Use of the Tide Table

Gaming in the Outdoors
Crayon Rubbings
Ink Prints
Sun Prints

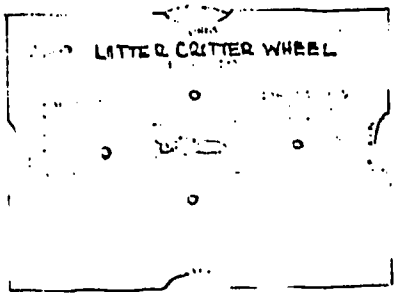
Litter Critters
Litter Shaker

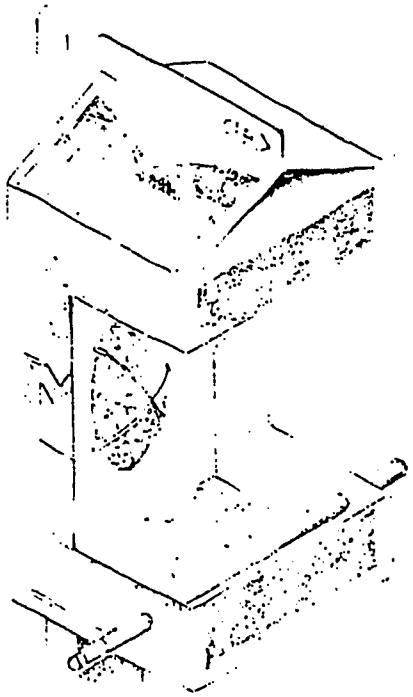
Metric Capers
Measuring Length
Measuring Volume

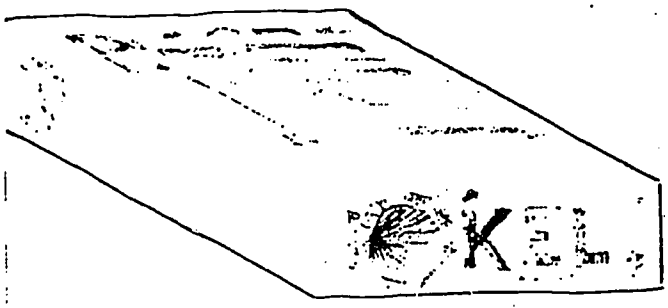
OBIS Oil Spill
Popcorn Slinger

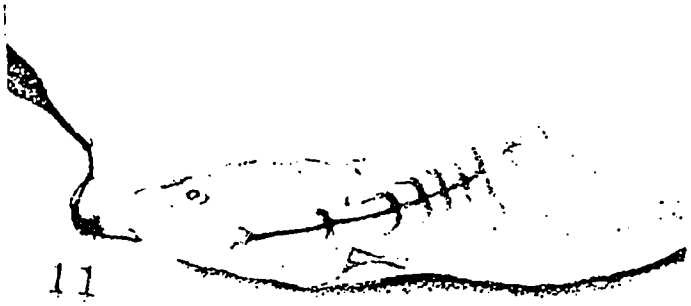
Rock Pioneers
Use of the Tide Table

Seas in Motion
Sand Stakes
Tide Stakes
Water Balloons
Marked Shells
Dye Markers
Tossing Cups
Use of the Tide Table









BASIC EQUIPMENT, AIDS, GUIDES

Data Board

Many OBIS activities call for the use of a data **board.** This board serves as a portable blackboard, record board, map, and all-purpose data organizer. Because your participants probably will not have a desk or locker for storage of records from one investigation to the next, a data board allows you to maintain a continuing record. The data board relieves youngsters of the burden of pencils and notebooks. Important terms can be easily viewed by all group members, and field observations are conveniently displayed in one place for group consideration.

Making a Data Board

1. You will need a piece of thick cardboard, masonite, or fiberboard for a data board. A good size is 80 cm x 60 cm.

2. Attach paper sheets (butcher or other) to the board.

3. Crayons or felt-tip markers are good for recording data because they leave broad marks and come in a variety of colors, allowing for easy color coding.

As an alternative, you can use a large sketch pad or small blackboard.

Comparison of Data

Some OBIS activities require comparisons of data collected on different occasions, but at the same activity site. It is often convenient to record the data on plastic overlays on a data-board map of the site. A good source of overlay plastic is inexpensive plastic dropcloth material sold at paint stores and discount variety stores (wax paper also works well). Data can be recorded on one overlay during one investigation, and on others at subsequent investigations. For comparison of data, simply stack up the overlays.

Lawn and Pond Organism Guides

These guides are designed for quick, easy identification of some of the most commonly encountered lawn and pond organisms. Only those organisms readily observed by the unaided eye or by means of a simple magnifying lens have been included.

To use the guides, simply flip through the pages until you come to a drawing that corresponds to the organism you wish to identify. Because the drawings are black and white and do not move, be sure to explain to your group that the organisms located will not exactly match the guide's drawings. The investigator should look for the drawing that most closely resembles his organism.

Action Cards

Many folios contain activity cards, which must be duplicated in order to provide sufficient copies for the youngsters. These cards, and in some cases the equipment cards, may be duplicated on any copying machine and the master sheet saved for future activities. We suggest you do the copying before the activity period and, in the case of summer camps or wilderness situations, before leaving the office machine behind.

Each sheet of action cards contains four cards. Cut the copies apart and give one card to each participant. In some cases, we provide blank cards which allow you to create additional challenges that are suited to your particular environment.

Equipment Card — Animal Diversity

SWEEPNET

Outdoor Biology Instructional Strategies

MATERIALS:

1 wire coat hanger

1 stick (approximately 1 meter long) for your net handle

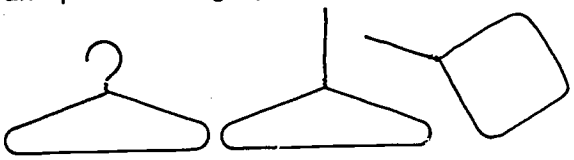
1 piece of cheese cloth or netting for the net bag (1 square meter)

1 needle and thread for sewing (or a sewing machine)

1 piece of tape or wire to attach net to handle

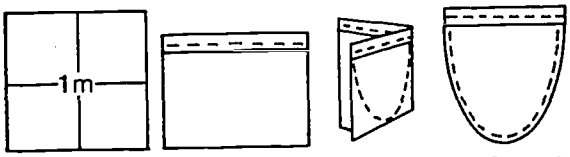
1. Preparing the hoop.

Take a wire coat hanger, straighten the hook, and pull the hanger into a square:



2. Preparing the bag.

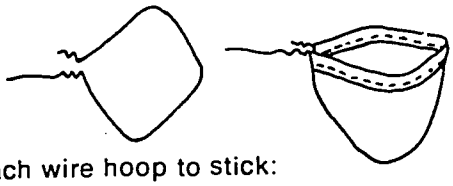
Your net should be approximately one meter in circumference at the top, tapering down to a point. A sewing machine speeds up construction, but older kids can hand sew the nets if sufficient time is provided. Sew like this:



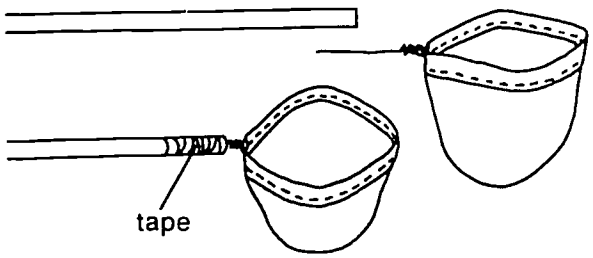
Fold one edge down and sew | Fold square in half and sew | Cut off excess

3. Assembling the net.

Open the wire square and thread on the net:



Attach wire hoop to stick:

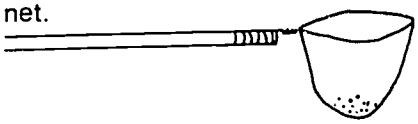


4. Using a sweepnet.

While a sweepnet can be used to pursue and capture an animal that has caught your eye, this is not the most efficient method of use. A sweepnet is best used as a random sampling tool. You walk at moderate speed across the grassy area, sweeping the net back and forth, in pendulum fashion, in front of you. The net should just brush across the top of the grass. The idea is to sweep any animals that are buzzing around in front of you into the nets, so you must turn the net in your hand to capture animals on both right and left swings of the net. After you have made fifteen to thirty swings of the net, make a quick swing around your head to concentrate the animals at the bottom of the net, and grab the end of the net in your hand to keep the catch from escaping.

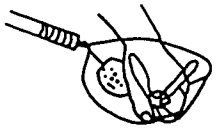
How to transfer animals from net to observation bag:

A. Concentrate animals in the bottom of the net.

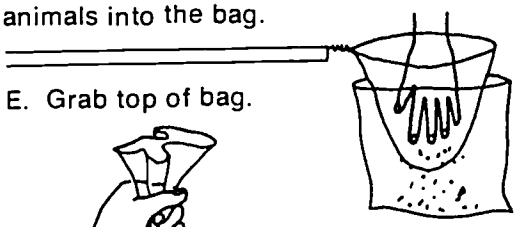


B. Pinch the net closed, keeping the animals in the bottom of the net.

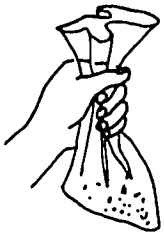
C. Turn net inside out while holding animals.



D. Place net in plastic bag, release and shake animals into the bag.



E. Grab top of bag.



F. Twist the top a couple of times and tuck the top under your belt or into an open pocket while you continue to sweep.

13 : 14

Equipment Card — *Birdfeeder*

BASIC BIRDFEEDER

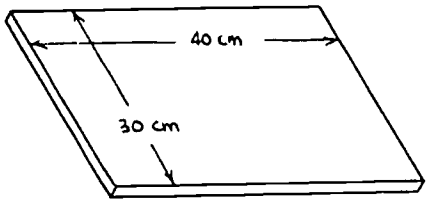
Outdoor Biology Instructional Strategies

MATERIALS:

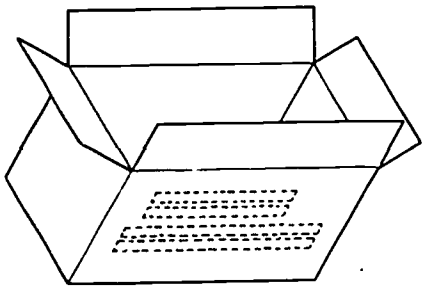
1 piece of wood (30 cm x 40 cm and ¼" to 1" thick)
1 stiff-cardboard box (at least 40 cm on one side)
20 tacks
1 stake (1.5 m in length)
1 hammer and a few large nails

To build your basic birdfeeder:

1. The platform can be of ¼" to 1" wood.



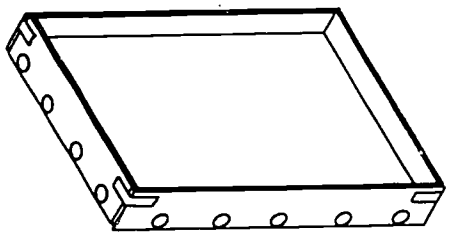
2. Cut edging (to prevent seed from spilling) from a stiff cardboard box.



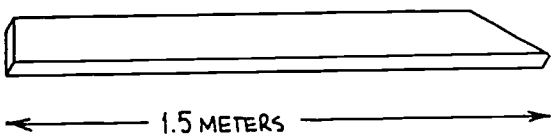
2 30 cm x 3 cm strips

2 40 cm x 3 cm strips

3. Tack the edging to the platform and tape the corners together.

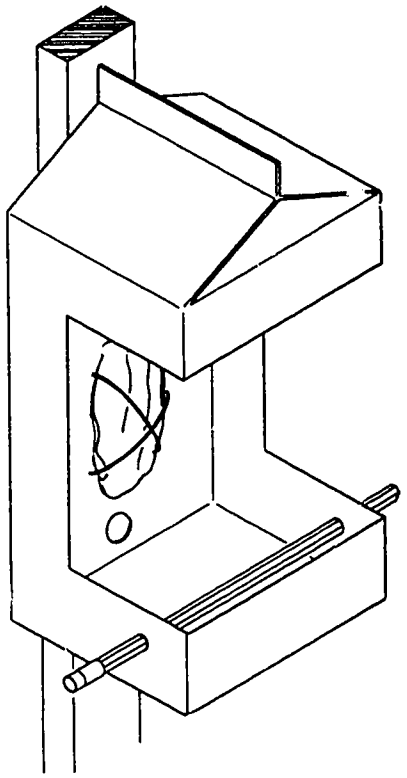


4. Pound the stake firmly into the ground. Then nail the platform to the stake.



FUN FEEDERS TO TRY

MILK CARTON

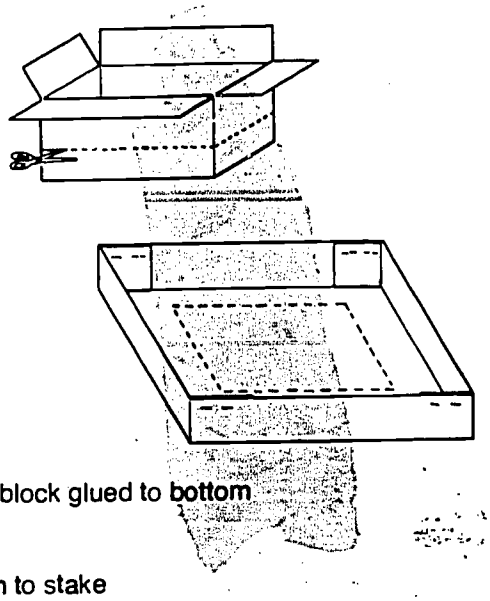


Tie suet to back of milk carton by pulling string through milk carton and tying around the stake.

Thumbtack milk carton to stake.

CARDBOARD BOX

Cut the cardboard box.



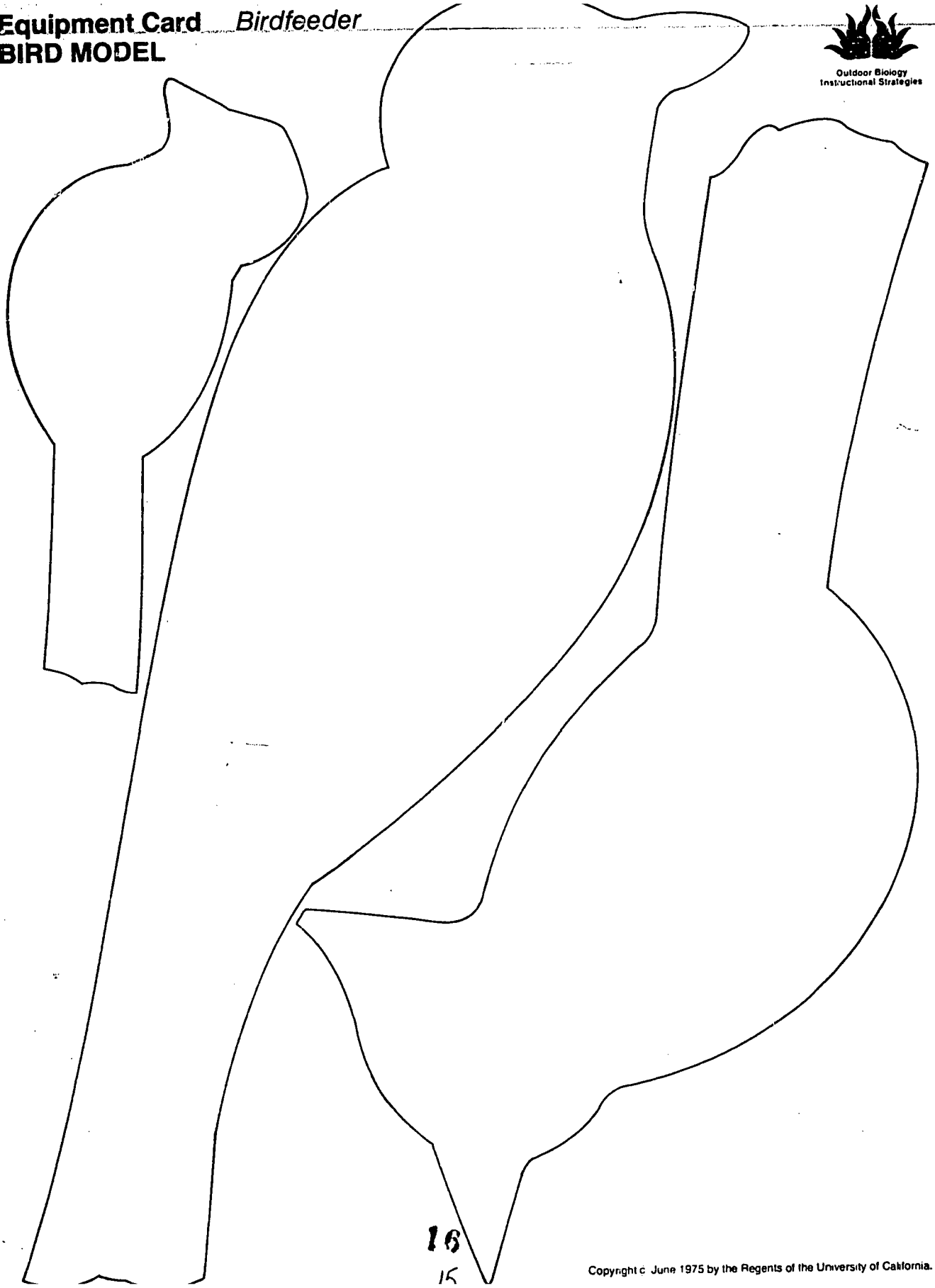
large wood block glued to bottom for strength

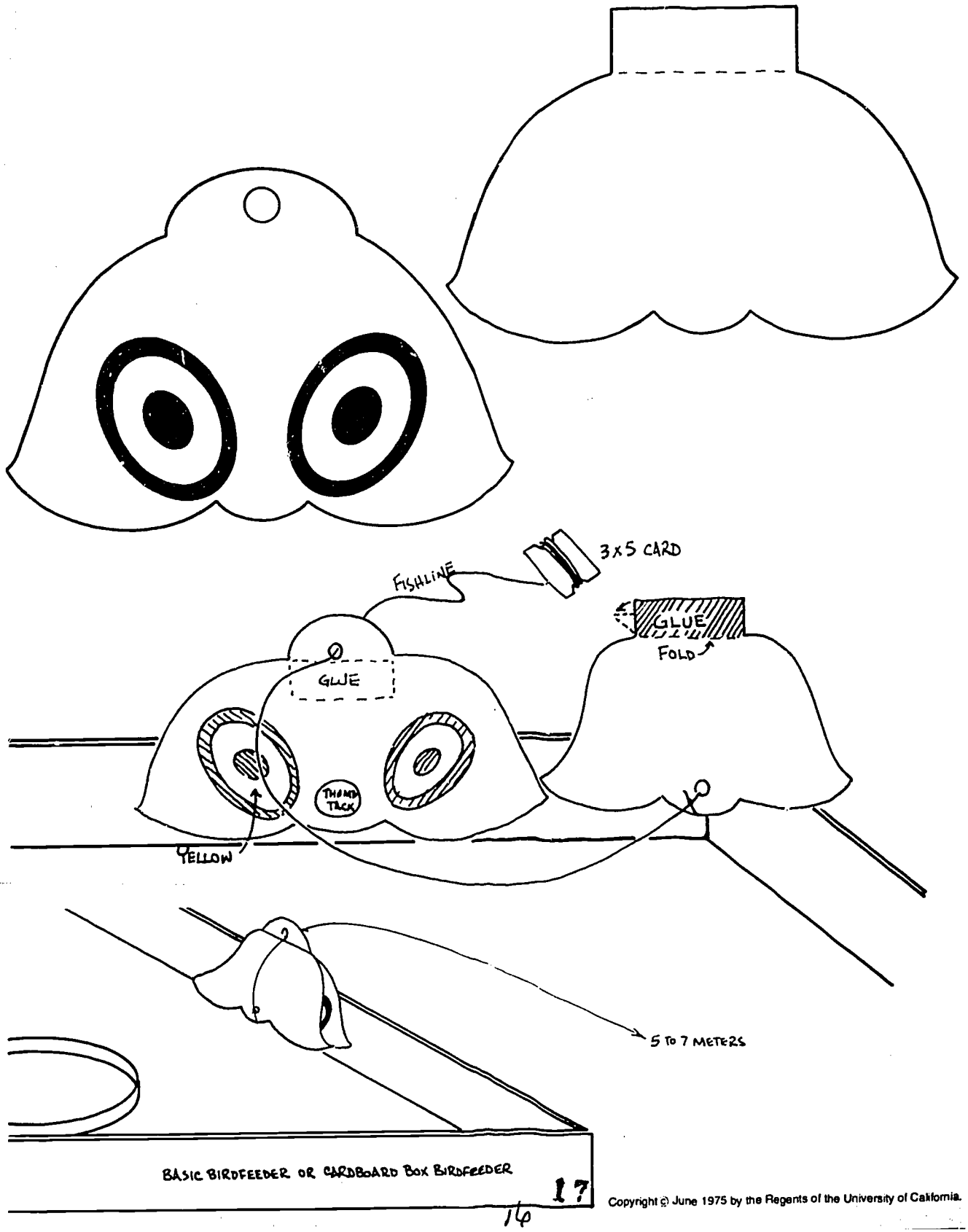
nail platform to stake

Equipment Card *Birdfeeder*

BIRD MODEL

Outdoor Biology Instructional Strategies





BASIC BIRDFEEDER OR CARDBOARD BOX BIRDFEEDER

17

MEASURING LENGTH

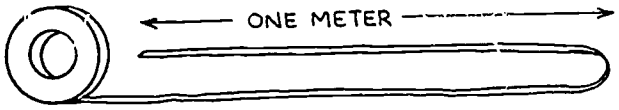
Outdoor Biology Instructional Strategies

MATERIALS:

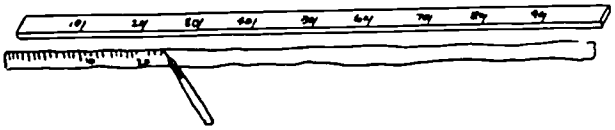
1 marking pen that marks on anything (such as Sanford's "Sharpie")
1 roll of masking tape, or 1 strip of 4 or 6 mil plastic sheeting
1 meter stick

To make your meter tape:

1. Unroll 2 meters of tape and double it over, sticky sides together.

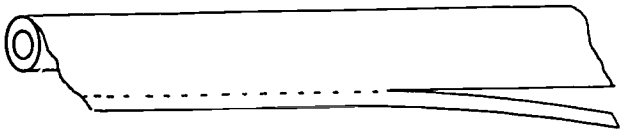


2. Use your meter stick to calibrate your tape with your marking pen.



OR:

1. Cut a 2-cm strip of plastic from a roll of plastic sheeting (4 or 6 mil).



2. Calibrate the sheeting by using the meter stick and marking pen.

MEASURING VOLUME

Outdoor Biology Instructional Strategies

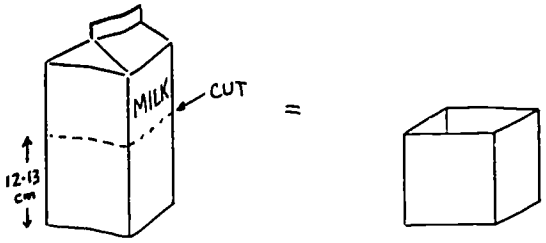
MATERIALS:

1 half-gallon milk carton
1 meter stick or meter tape*
1 pair of scissors
1 250-ml measuring cup*

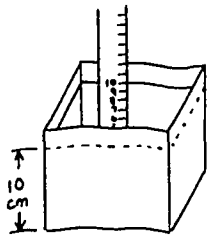
*Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

How to make a 1-liter cup (1000 ml):

1. Cut off the top of the milk carton 12 to 13 cm from the bottom.

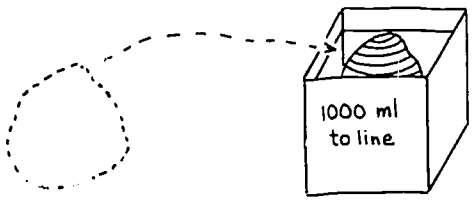


2. Draw a line inside the milk carton 10 cm from the bottom.

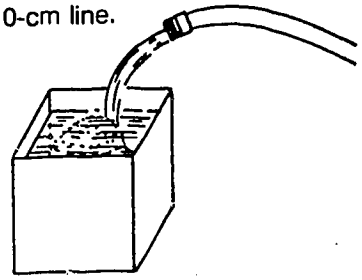


To use your liter cup:

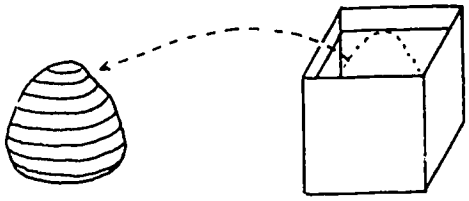
1. Place the object, the volume of which you wish to determine, in the container.



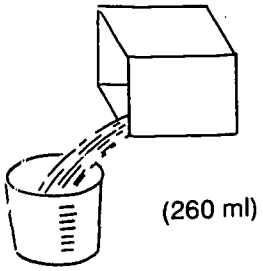
2. Add water to the 10-cm line.



3. Remove the object.

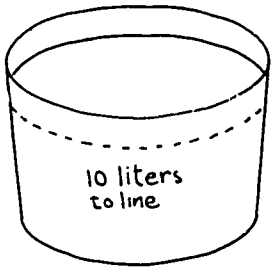


4. Measure the water using your 250-ml measuring cup.



5. Calculate the volume of the object:
   1000 - 260 = 740 ml (the volume of the object)

Use your liter cup to make a standard 10-liter bucket. Use this bucket in the same way for measuring the volume of larger objects.



Equipment Card
LITTER SHAKER

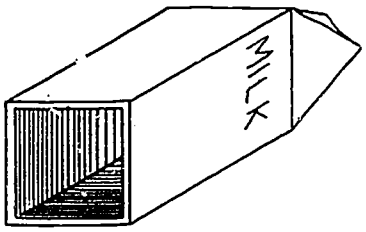
Outdoor Biology Instructional Strategies

MATERIALS FOR SHAKER:

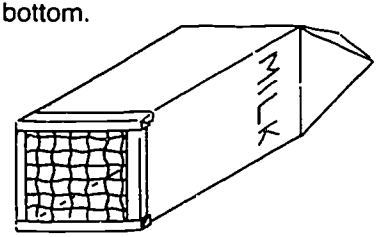
1 half-gallon milk carton
1 9 cm x 9.5 cm piece of hardware cloth screening (½ inch)
1 single-edged razor blade or knife
1 roll of reinforced filament tape or masking tape

TO MAKE YOUR SHAKER:

1. Cut out the bottom of a half gallon milk carton.



2. Tape the square of hardware cloth to the carton bottom.



3. Your shaker is now ready to use.

TO USE YOUR SHAKER:

1. Place litter by handfuls into the carton until it is about half full. Hold the top edges of the carton closed.
2. Shake the carton up and down three or four times over a white-bottomed container. The shaking agitates the animals in the litter and they fall into the container. Because they are agitated, the animals usually scurry about in the pan and are easy to see. Most of the animals will come out in the first or second set of shakes. Check around the screen on the bottom to be sure no animal is stuck to the tape or too big to come through the screen.
3. When you think all the animals are out of the litter in the shaker, dump the litter, put in some new litter, and shake away.

NOTE: It is important to work fast when scooping up litter to put in the shaker because litter critters often move fast.

Equipment Card
POPCORN SLINGER

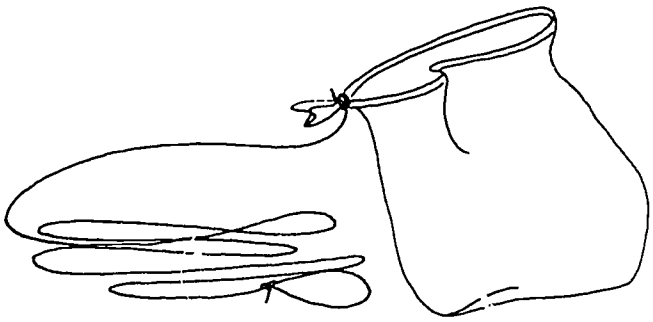
Outdoor Biology Instructional Strategies

MATERIALS:

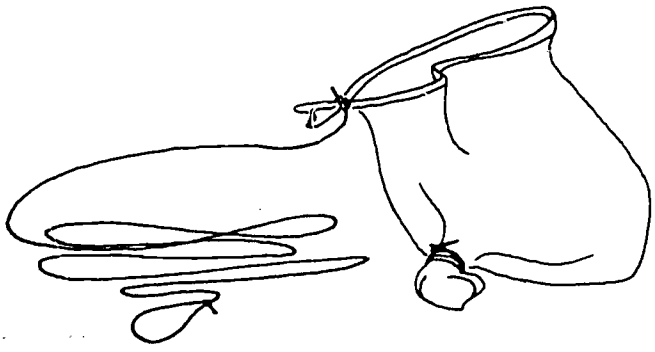
1 cloth bag (burlap, pillow case, feed bag, etc.)
25 meters of heavy twine or light rope marked off in 5-meter intervals

To make a popcorn slinger out of a cloth bag:

1. *Firmly* tie the 25-meter line to one corner of the open end of the bag and tie a loop (large enough to go over a nearby rock or post) at the other end of the rope.



2. Place a weight, such as a rock the size of a tennis ball, in the bottom of the bag and tie it off in one corner to hold it in place.



To use your popcorn slinger:

Practice tossing the empty popcorn slinger a few times before putting in the popcorn. Once you get the feel of it, fill the popcorn slinger with about 20 liters of popped corn and take a strategic position (dock, breakwater, large rock, etc.) from which to toss the corn. Have someone else slip the loop over a rock or post and keep the line tangle-free so it does not hinder the bag's flight. (The loop around the rock keeps the bag from being lost at sea.)

When everything is ready, grab the rope near the bag and start twirling the popcorn slinger over your head. When the bag has gathered momentum, let it fly out over the water. After landing, the weight will pull the bag under the water and the buoyant popcorn will be forced out of the opening of the bag. Before hauling the bag in, let it sink beneath the surface so as not to disturb the spill.

Count the marked intervals as you haul in the bag to determine the spill's starting distance from the shore.

TIDE STAKES

MATERIALS:

4 short fence stakes or wooden dowels (about 60 cm long)
2 meter sticks or meter tapes*
2 waterproof marking pens

Mark your 60-cm stake at 1-cm intervals, starting 15-cm from one end.

Measuring Tidal Movement

Vertical Tide Change. At a point inside the active wash zone (where the sand is wet), push the unmarked end of the stake into the sand until the first mark is flush with the surface of the water. When you recover the stake (near the end of the activity), slide your hand down to the water level and pull out the stake. The space between the bottom of your hand and the first mark represents the net gain or loss of water during the time the stake was planted.

Horizontal Tide Change. Sink two stakes into the beach to mark the highest point currently reached by the incoming wave wash. By the end of the period, the tide stakes will either be standing above or below the incoming wave wash. Move one of the stakes to the new highest point, directly inshore or offshore from the remaining stake. The distance between the two stakes marks the horizontal tide change during the period.

*Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

SAND STAKES

Outdoor Biology Instructional Strategies

MATERIALS:

4 short fence stakes or wooden dowels (about 60 cm long)
2 meter sticks or meter tapes*
2 waterproof marking pens

Mark your 60-cm stake at 1-cm intervals, starting 15-cm from one end.

Measuring Sand Movement

At a point inside the active wash zone (where the sand is wet), push the unmarked end of the stake into the sand until the first mark is flush with the top of the sand. When you recover the stake (near the end of the activity), slide your hand down to the sand level and pull out the stake. The space between the bottom of your hand and the first mark represents the net gain or loss of sand during the time the stake was planted.

*Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

WATER BALLOONS

MATERIALS:

12-24 colored, medium-sized balloons
2 turkey basters (giant-dropper type)
1 bucket of sea water

Optional:

dye markers

In the ocean, the ever-popular water balloon can be a neutrally buoyant object (filled with sea water) or a floating object (filled with fresh water). Use the turkey basters to fill the balloons, keeping them the size of tennis balls. To remove air bubbles, gently squeeze the balloons until all the air is removed and then tie them off. You can hand toss the balloons into the water or use a fishing rod. Attaching a dye marker to a balloon will help you trace the balloon's movement.

DYE MARKERS

Outdoor Biology Instructional Strategies

MATERIALS:

- powdered confectioners dye*
- string

6-10 small cloth bags (teabags, candy or tobacco pouches, or handmade cheesecloth bags)

Confectioners dyes are water soluble and extremely concentrated. Moisten a tablespoonful of dye with water until the dye is gooey; let it dry. Break the resulting cake into pieces the size of a dime and put one piece in each empty tea or cloth bag. Adding a little sand to the bag will make it easier to throw or cast the bags. Dye markers can be tied with string to water balloons and other objects.

*Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

WATCH OUT!

Confectioners dye is **extremely concentrated.** *Avoid direct contact to prevent stains on hands and clothing!*

MARKED SHELLS

MATERIALS:

- shells
2 waterproof marking pens
2 watches with second hands
2 meter sticks or tapes*

By marking some shells, you can investigate the way the sea moves them. Collect some shells from the beach and mark them on both sides with waterproof marking pens. Toss the shells into the surf either by hand or with your screen-bottomed cup. Clock the amount of time it takes for the marked shells to wash ashore. Measure the horizontal distance the shells travelled from the delivery point to the point where the shells land on the beach.

*Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

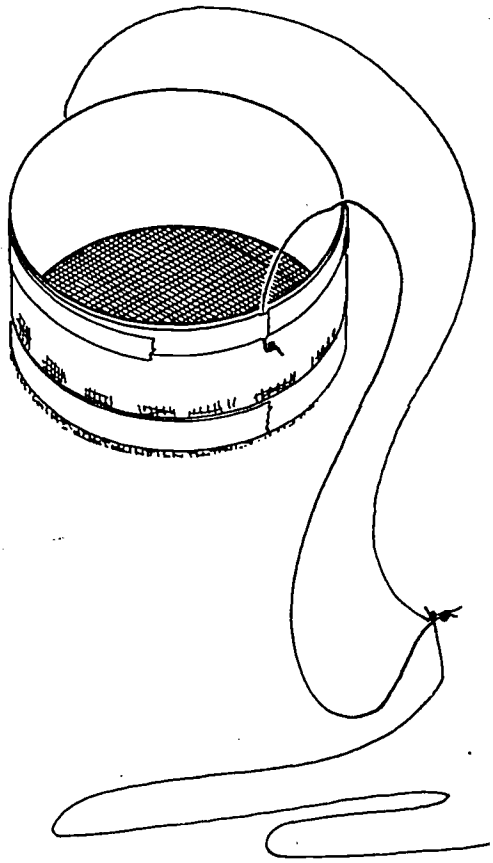
TOSSING CUP (optional)

Outdoor Biology Instructional Strategies

MATERIALS:

1 small can or plastic cup
1 piece of screen or gauze
- filament or masking tape
- string

You can use a small cup or can to toss objects into the surf by hand or with a fishing rod. Remove the bottom of the cup or can and tape screen or gauze over the bottom. (This cuts down resistance and makes it easier to retrieve the cup.) Masking tape works, but filament tape is better. Cut two pieces of string approximately 25 cm long and tie knots at both ends of each string. Tape the strings to the top of the cup to form a harness. You can now use the cup to toss such objects as marked shells or dye markers into the surf.



Technique Card
DETERMINING HIGH TIDE LEVEL

Outdoor Biology Instructional Strategies

MATERIALS:

1 tide table
1 tide marker flag
1 yard stick
1 line level
1 long stick (up to 8')
1 ball of string

1. To determine the high tide level you will first need to determine the present level of the tide. Check the tide table to see what the tide is at the present time. You will have to estimate if the tide is not at a high or low point at this moment. Example:

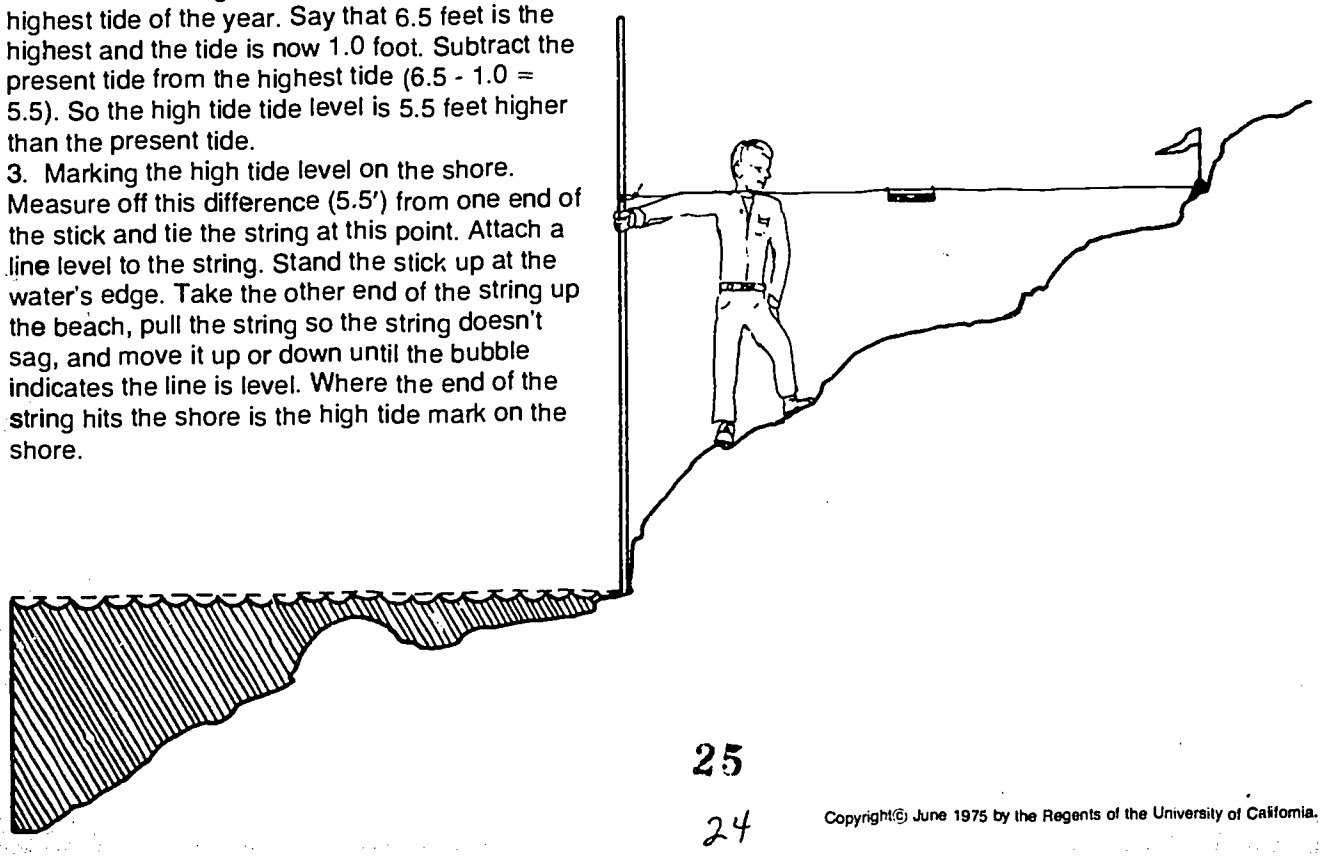
The time is now 2:45 p.m.

Tide table says:	9:05 a.m.	5.6'	(high)
	3:48 p.m.	.5'	(low)

From 9:05 a.m. to 3:48 p.m. (approximately seven hours), the tide will go out (ebb) about 5 feet. So you can estimate that the tide right now is about 1 foot.

2. Now leaf through the tide table and find the highest tide of the year. Say that 6.5 feet is the highest and the tide is now 1.0 foot. Subtract the present tide from the highest tide (6.5 - 1.0 = 5.5). So the high tide tide level is 5.5 feet higher than the present tide.

3. Marking the high tide level on the shore. Measure off this difference (5.5') from one end of the stick and tie the string at this point. Attach a line level to the string. Stand the stick up at the water's edge. Take the other end of the string up the beach, pull the string so the string doesn't sag, and move it up or down until the bubble indicates the line is level. Where the end of the string hits the shore is the high tide mark on the shore.



USE OF THE TIDE TABLE

With a tide table (available from boating, fishing, and diving shops), you can look up the tidal conditions in your area for any time of any day. Leaf through your table. You may see a range of tides from minus one or two feet to plus six or seven, depending on where you are. Areas may differ, but the range will be consistent month after month. From this information you can determine the vertical height of the intertidal zone. (Subtract the lowest-low from the highest high.) Let us say that in looking in the tide book for the day and time you wish to investigate, you find that the tide is two feet. This means that the upper four to five feet of the intertidal zone is exposed.

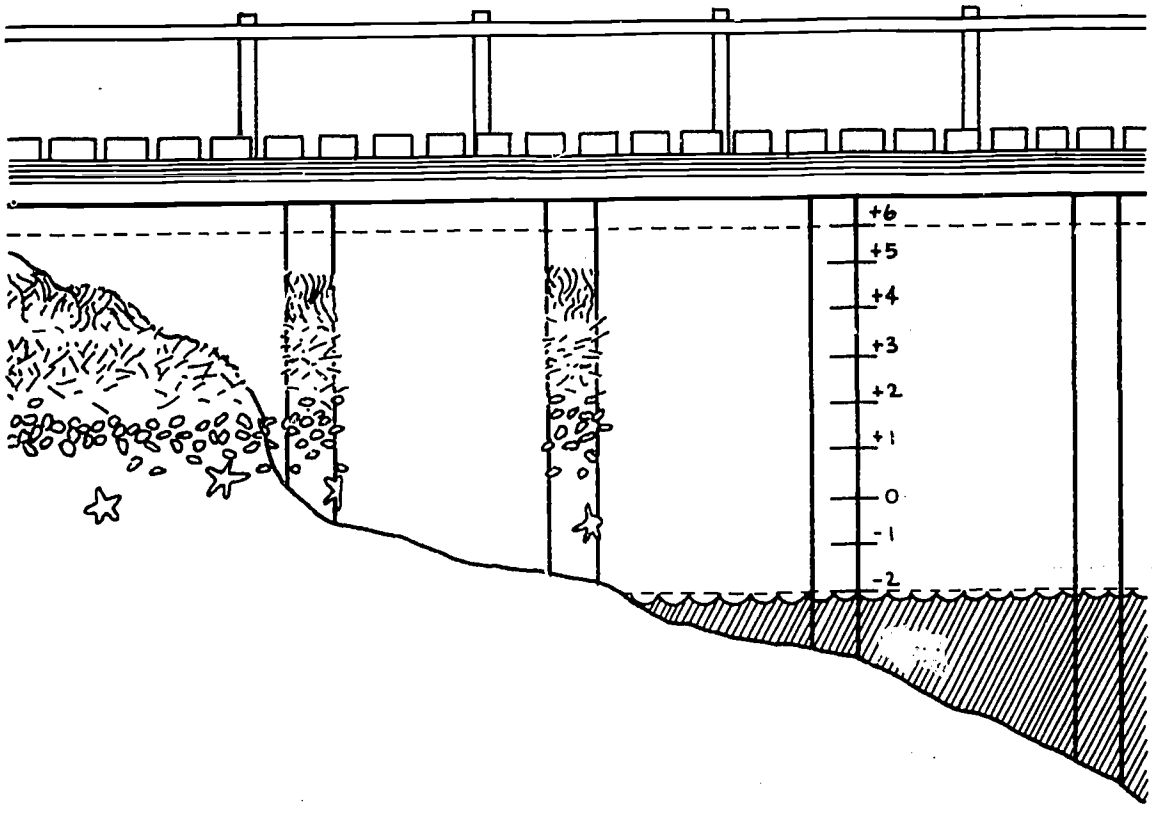
If it is not a high or low tide when you want to study your coastal community, you will have to estimate the height of the tide.

Example: You meet your group at 10:00 a.m.

The tide table reports:

Low Tide:	6:53 a.m.	1.5′
High Tide:	1:10 p.m.	5.1′

10:00 a.m. is about half way between 6:53 a.m. and 1:10 p.m., so your tide will be about half way between 1.5′ and 5.1′ or about 3.2′, and coming in (flood tide). After 1:10 p.m. the tide will be going out (ebb).



Outdoor Biology Instructional Strategies

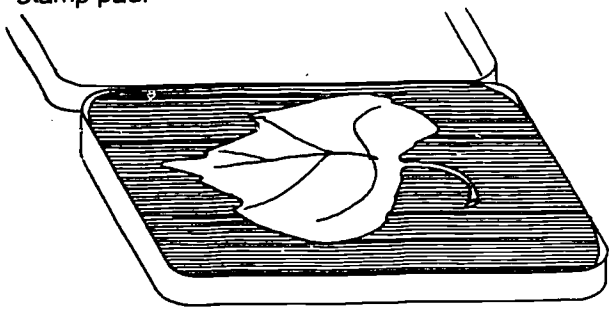
Technique Card
INK PRINTS

MATERIALS FOR ONE PRINT:

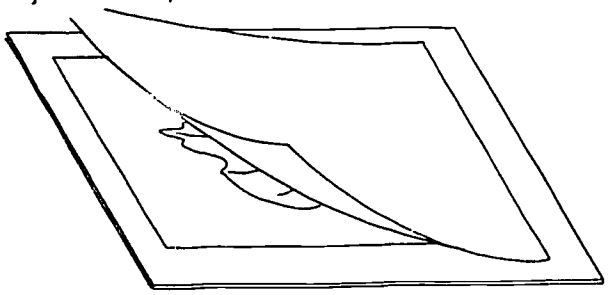
1 ink stamp pad (or ink-covered sponge in container)
2 pieces of paper
1 piece of cardboard backing

PROCEDURE

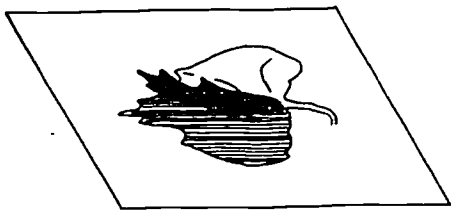
1. Press the object to be printed against the ink stamp pad.



2. Remove and place the object ink-side down on paper against a cardboard backing.
3. Place another piece of paper over the object. (This prevents inky finger prints from obscuring object outline.)



4. Press down firmly over the entire object to transfer ink from the object to the paper.



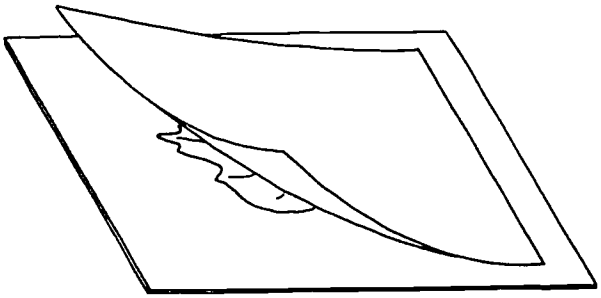
Technique Card
CRAYON RUBBINGS

MATERIALS FOR ONE PRINT:

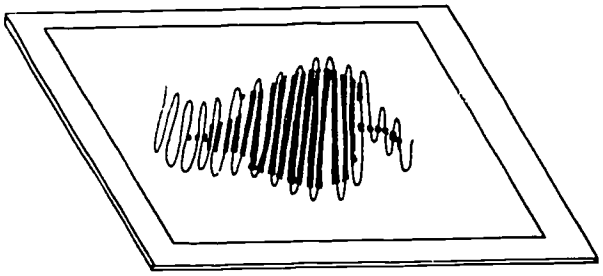
1 piece of cardboard backing
1 piece of paper
1 crayon

PROCEDURE

1. Place the object to be printed on the cardboard or on another hard surface and cover the object with a piece of paper.



2. With a crayon, make a rubbing on the paper over the entire object.



Technique Card
SUN PRINTS

Sun prints are photographs made without camera or darkroom. These prints provide outdoor groups with an interesting method of recording evidence of plants and animals in their natural environment.

MATERIALS

For the group (developing materials):

2 or 3 wide-mouthed, gallon jars of plastic or glass with tops
3-4 cups of gravel or sand
1 grocery bag for each one-gallon container
1 pint of household, non-sudsy ammonia

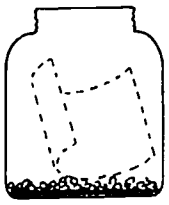
For each individual or team:

- ozalid paper* in lightproof envel es (15 cm x 20 cm is a good size)
1 plate of glass or piece of plastic food wrap

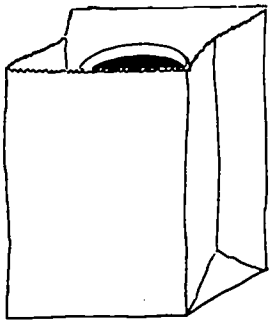
*Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

HOW TO MAKE A SUN PRINT

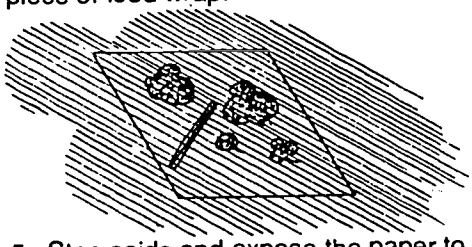
1. Pour enough household ammonia into each one-gallon jar to cover the bottom of the jar.
2. Pour two cups of sand or gravel into the jar and mix it with the ammonia. There should be enough gravel to prevent the ozalid paper from touching the ammonia.



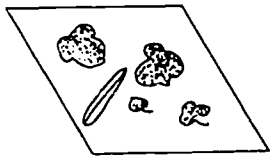
3. Set the jar in a grocery bag to prevent strong light from penetrating the jar.

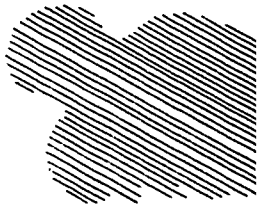


4. In the shade of your body, remove one sheet of ozalid paper and arrange organisms and objects on the paper. Covering the objects with a clear plate or plastic food wrap will hold the objects flat against the ozalid paper. If objects are wet, place them on top of a glass plate or piece of food wrap.



5. Step aside and expose the paper to direct sunlight for fifteen to thirty seconds.





6. Pick up the paper and quickly put it into the jar. Put the cover on the jar and allow the paper to develop until the image appears (about one minute).
7. If the ozalid prints take too long to develop, or appear too weak, shake up the gravel in the jar to reactivate the fumes. If this doesn't help, add more ammonia.

OBIS TRIAL EDITION SET I

The activities listed below appear in the **OBIS Trial Edition Set I** packet, which is still available from the Lawrence Hall of Science. See the "Equipment Order Form" in this folio if you would like to purchase the first packet.

Adaptation – Predator-Prey (All habitats)
Animal Movement in Water (Aquatic habitats)
Animals in a Grassland (Lawns, meadows, and fields)
Attention! (All habitats)
Bean Bugs (Terrestrial habitats)
Great Streamboat Race (Streams)
Habitat Sun Prints (All habitats)
Habitats of the Pond (Ponds and lakes)
How Many Organisms Live Here? (Ponds and lakes)
Invent a Plant (All habitats)
Invent an Animal (All habitats)
Mapping a Study Site (All habitats)
Moisture Makers (Terrestrial habitats)
Natural Recycling in Soil (Terrestrial habitats)
Natural Recycling in Water (Aquatic habitats)
Out of Control (Lawn)
Plant Hunt (Terrestrial habitats)
Plants Around a Building (Building sites)
Seed Dispersal (All habitats)
Sticklers (Terrestrial habitats)
Terrestrial Hi-Lo Hunt (Terrestrial habitats)
Water Holes to Mini-Ponds (All habitats)
What Lives Here? (Aquatic habitats)
Who Goes There? (Terrestrial habitats)

OUTDOOR BIOLOGY INSTRUCTIONAL STRATEGIES

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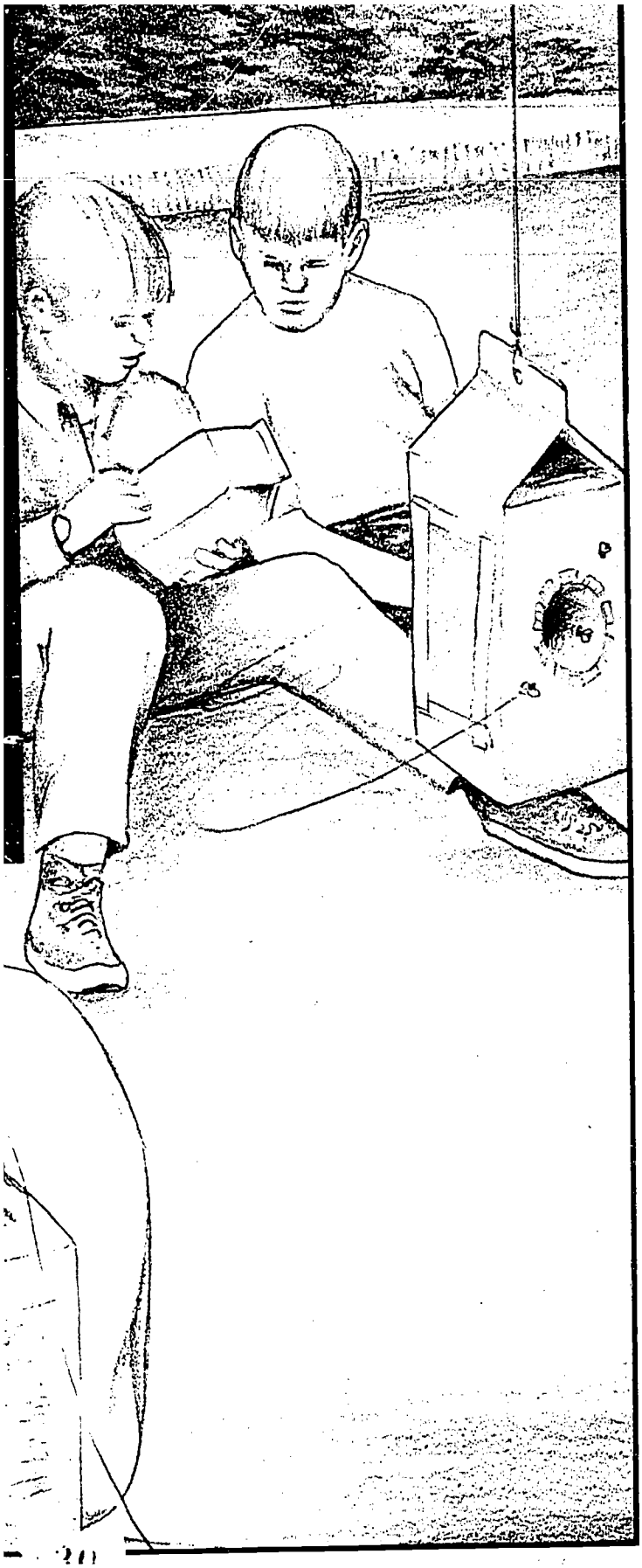

WHAT DO YOU THINK?

- ☐ How do flies approach the trap?
- ☐ Why do you think the flies don't escape?
- ☐ What happens when you rattle the trap?
- ☐ What other organisms are attracted and caught by your trap?
- ☐ What recommendations do you have for a home or camp with a fly problem?
- ☐ What feeding role do you see flies playing in the ecosystem?

FOLLOW THROUGH

- ☐ Try different or wetter baits.
- ☐ Try suspending the trap from a long string to see if flies will land on a moving object.
- ☐ Paint your trap different colors to see if color makes a difference in fly catching.
- ☐ Make more traps and sell them.
- ☐ Does your trap catch more flies at night or during the daytime?

Disposing of captured flies. Flies may be sold to pet shops as frog and turtle food, submerged in water and released as fish food, left in the traps to become bait for other flies, let go, etc.

The last thing to do: Have the kids wash up!

WHAT TO DO NEXT

	Set
Too Many Mosquitoes	II
Crawdad Grab	II
Old White Sheet Trick	II

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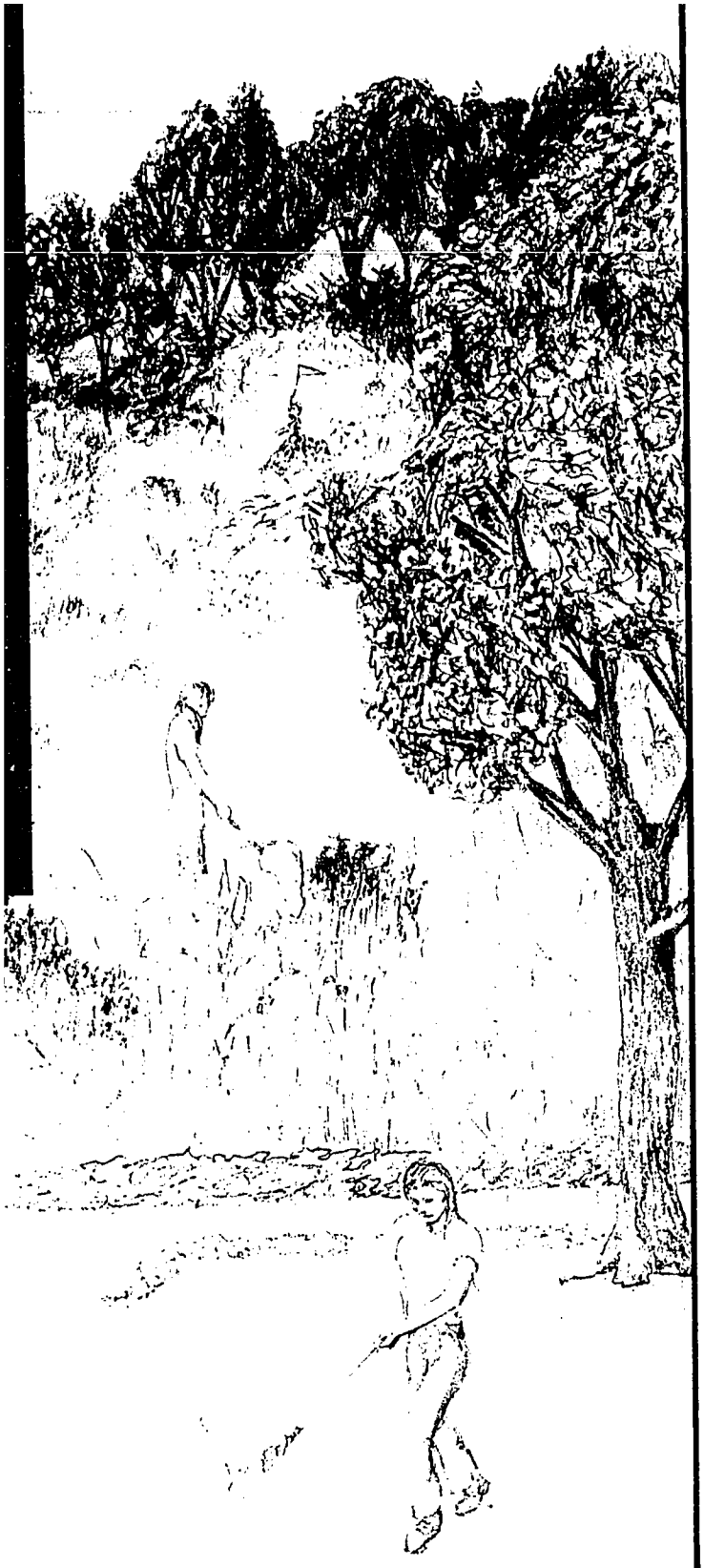
Animal diversity refers to the
of different kinds of animals liv
an area. The diversity of anima
reflects, in part, the diversity o
vegetation in that area. Animal
plants not only for food, but als
shelter, shade, moisture, and
protection from wind.

Consider a well-managed lawn
basically only grasses grow; th
number of animals that can us
plants for food or shelter is
limited. An unmanaged lawn w
addition to grasses, weedy pla
which provide living places for
additional kinds of animals. A
weedy field with taller grasses
shrubs will provide living place
even more kinds of animals. M
controls the diversity of anima
on the managed lawn not only
weed control, but also by
direct pest control.



THE CLEAN SWEEP

☐ What are some of the differences between numbers and kinds of animals found in the managed site and those found in the unmanaged site? How might you account for these differences?

☐ Introduce the term **animal diversity**: the number of different kinds of animals found in an area. How does man influence the diversity of animals?

☐ What might be some of the advantages for an insect or other small animal in having a diversity of plants and animals in an area? Consider food sources and living places.

☐ As a human, which of the two areas do you prefer and why?

☐ If an area is not a suitable living place for a certain animal, that animal simply will not be found there. Do you think this applies to humans as well as other animals?

FOLLOW THROUGH

Finding the most popular plant. Bring out the plant cards and explain that each team will select one card and go into the weedy site and bring back those animals associated with the plant on the card. (No sweepnets allowed this time! The participants use only plastic bags and vials or bug boxes.) The plant associated with the greatest diversity of animals will be the most popular plant. Which plant was the most popular? Did you notice certain animals associated with only one kind of vegetation?

WHAT TO DO NEXT

	Set
Old White Sheet Trick	II
Plant Patterns	II
Plant Hunt	I
What Lives Here?	I

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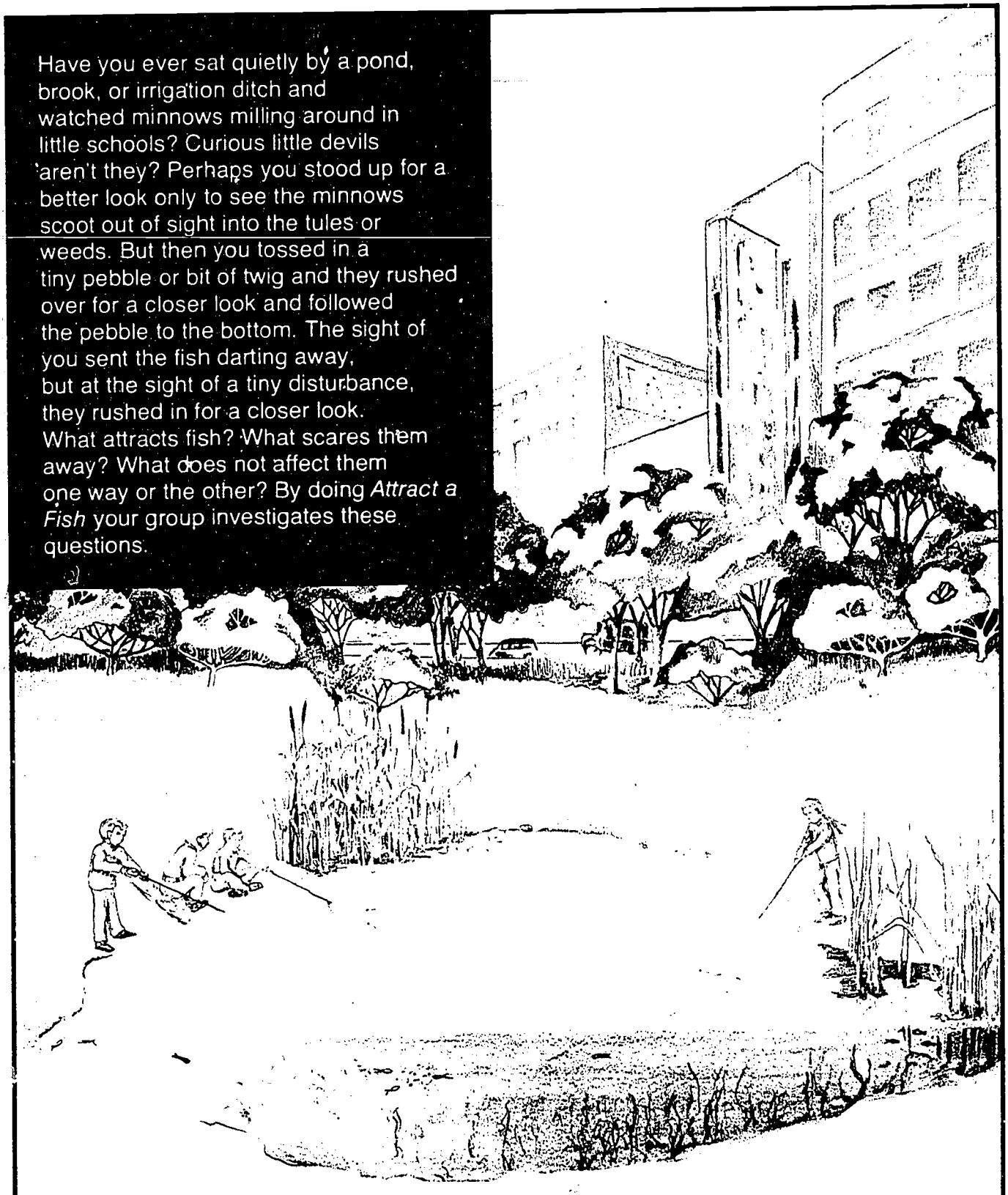
Have you ever sat quietly by a pond, brook, or irrigation ditch and watched minnows milling around in little schools? Curious little devils aren't they? Perhaps you stood up for a better look only to see the minnows scoot out of sight into the tules or weeds. But then you tossed in a tiny pebble or bit of twig and they rushed over for a closer look and followed the pebble to the bottom. The sight of you sent the fish darting away, but at the sight of a tiny disturbance, they rushed in for a closer look. What attracts fish? What scares them away? What does not affect them one way or the other? By doing *Attract a Fish* your group investigates these questions.



A NEW ANGLE

Explain to the kids that they have systematically discovered a lure that stimulates fish to bite. Use your super lure to investigate the following questions. You may wish to make action cards from these ideas and any others that you or the kids come up with.

☐ Do fish get tired of your super lure and ignore it? How long does it take?

☐ How far away can a fish be and still sense your super lure?

☐ Can you bring a super lure up behind a fish without it detecting the lure? Does the fish eventually see the lure or might other senses be involved first?

☐ Will two fish fight over your super lure?

☐ What happens when you skim your super lure rapidly across the surface of the water?

FOLLOW THROUGH

☐ Now you know what stimulates fish to bite. Go to the fish pond and locate some living organisms that might be food sources for the fish. If possible, catch some fish and keep them for a while in an aquarium. Try feeding them your potential live food.

☐ Can sound alone attract fish? Design an experiment to find out.

☐ What scares fish away?

☐ Can you discover a predator that preys on the minnows in your pond?

☐ What changes occur in a pond when fish are present? Set up a pair of identical mini-ponds, one with minnows and one without. (See *Water Holes to Mini-Ponds*, Set I.) Be sure to include some pond bottom, plants, and as many different kinds of animals as possible. Observe changes over a length of time.

WHAT TO DO NEXT

	Set
Old White Sheet Trick	II
Water Breathers	II
Animal Movement in Water	I
Water Holes to Mini-Ponds	I

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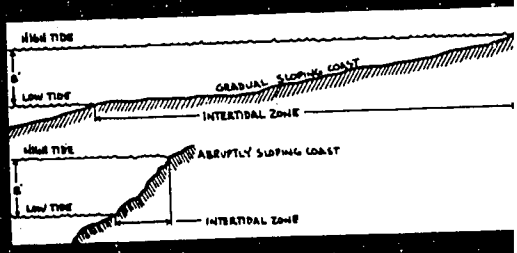
12

ACTION

water may result in an intertidal zone
extending several hundred feet up th
beach. Contrast this gradual slope w
rocky headland, seawall, or breakwa
where the slope of the coast is abrup
Here an eight-foot vertical rise mean
the water is eight feet deeper; in a sh
horizontal space the intertidal zone i
more compressed.



USE THE RANGE OF AN ORGANI LIVING AT YOUR STUDY SHORE DEFINE AN "UPPER ZONE."

When you go to the seashore at a
low tide, you can walk among the p
and animals of the intertidal zone a
often observe bands or zones of na
distribution. Some of the organisms
adapted for withstanding longer pe
of exposure to air than others and
found higher in the intertidal zone.
Those adapted for short exposures
are found lower in the intertidal zo

In this activity the youngsters divid
intertidal zone into two or more zo
You can make this investigation a
time the tide is at least half way ou
participants look for the organism
highest in the intertidal zone, disc
the organism's range (the vertical
of the area in which that organism
and arbitrarily designate that rang
the "upper zone."

FOLLOW THROUGH

1. During a lower tide, locate an organism whose range defines a lower zone. Do the two zones overlap?
2. During a low tide, stand and look at the intertidal zone. Can you see bands of similar organisms (brown seaweed, mussels, green seaweed, starfish)?

WHAT TO DO NEXT

	Set
Rock Pioneers	*II*
OBIS Oil Spill	*II*
Water Breathers	*II*
Habitats of the Pond	*I*

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Birds are everywhere: perc
feeding on lawns or sidew
on rooftops. Often you can
but do not see them. No ba
apartment ledge need be v
regular visits of these inter
animals. *Birdfeeder* also w
camps where birds are oft
comfortable feeding near

A simple birdfeeder will giv
opportunity to closely obse
their behavior. With a basi
variety of simple foods, an
of patience, you will be rev
close-up views of local bir
sparrows, chickadees, or b
birds will be attracted by th
the bolder birds.

BIRDFEEDER
Action Card #1

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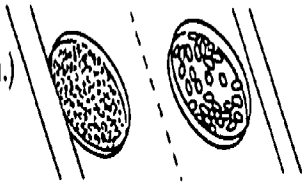
Instructional Strategies

Food Choice. Discover the preferred foods of birds in your area.

1. Use a hammer and nail to punch a hole through two jar lids and tack a lid to each end of your feeder.
2. Offer the birds a choice by filling each lid with a different food. Try one of the following combinations or create your own.
   a. small seeds and large seeds
   b. seeds and suet (Tie suet down.)
   c. raisins and suet
   d. popcorn and seeds



3. Check your feeder daily to see which foods the birds choose.
4. Over a period of several days, change the available food choices to discover which food the birds prefer.

BIRDFEEDER
Action Card #2

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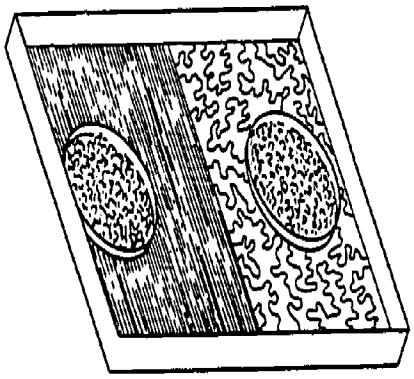
Instructional Strategies

Background. Discover the color, texture, and/or pattern of background that your birds prefer to eat from.

Divide your feeder in half. Use a different color, texture, or pattern in each half of the feeder. Fill each jar lid with the *same food*. Experiment for several days to see if the background design has any effect on the birds' feeding behavior.



BIRDFEEDER
Action Card #3

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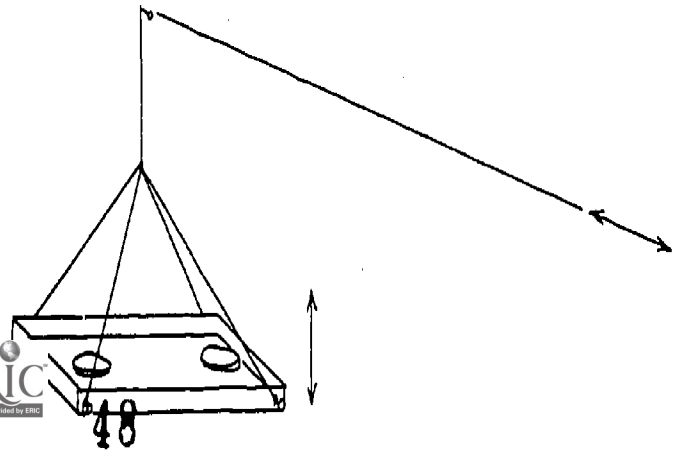
Instructional Strategies

Movement. Will birds eat from a hanging or moving feeder?

1. Insert a nail into each corner of your feeder. Attach fishline to the nails and hang your feeder from a tree limb or from house eaves.
2. While the birds are feeding, move the feeder up and down and see what the birds do.



BIRDFEEDER
Action Card #4

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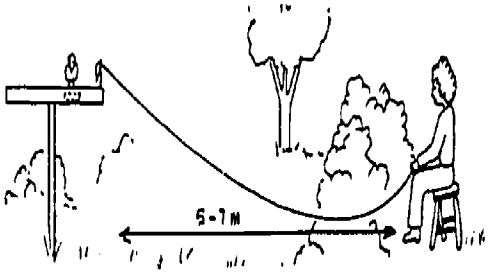
Instructional Strategies

Eyespots. How do birds respond to cat-eye and owl-eye spots on moths and butterflies?

1. Using the "Eyespot" equipment card, construct a moth model. Thumbtack the model to your feeder. "Flash" the eyespot by pulling the fish line when a bird lands on the feeder. Vary the size and color of the model.
2. What do the birds do when you flash the eyespot? Why do you think moths and butterflies are colored this way?



BIRDFEEDER
Action Card #5

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Models. How do birds respond to animal models? Construct models that will attract or frighten birds.

1. Use the patterns on the "Bird Model" equipment card and construction paper to make bird models. Paint or color them to resemble birds seen at your feeder. Thumbtack the models to your feeder and observe the reactions of the birds.
2. Try a clay snake model.

BIRDFEEDER
Action Card

Outdoor Biology Instructional Strategies

BIRDFEEDER
Action Card

Outdoor Biology Instructional Strategies

BIRDFEEDER
Action Card

Outdoor Biology Instructional Strategies

WHAT TO DO NEXT

Set
//
//
/
/

Flocking to Food
Plant Patterns
Adaptation – Predator-Prey
Who Goes There?

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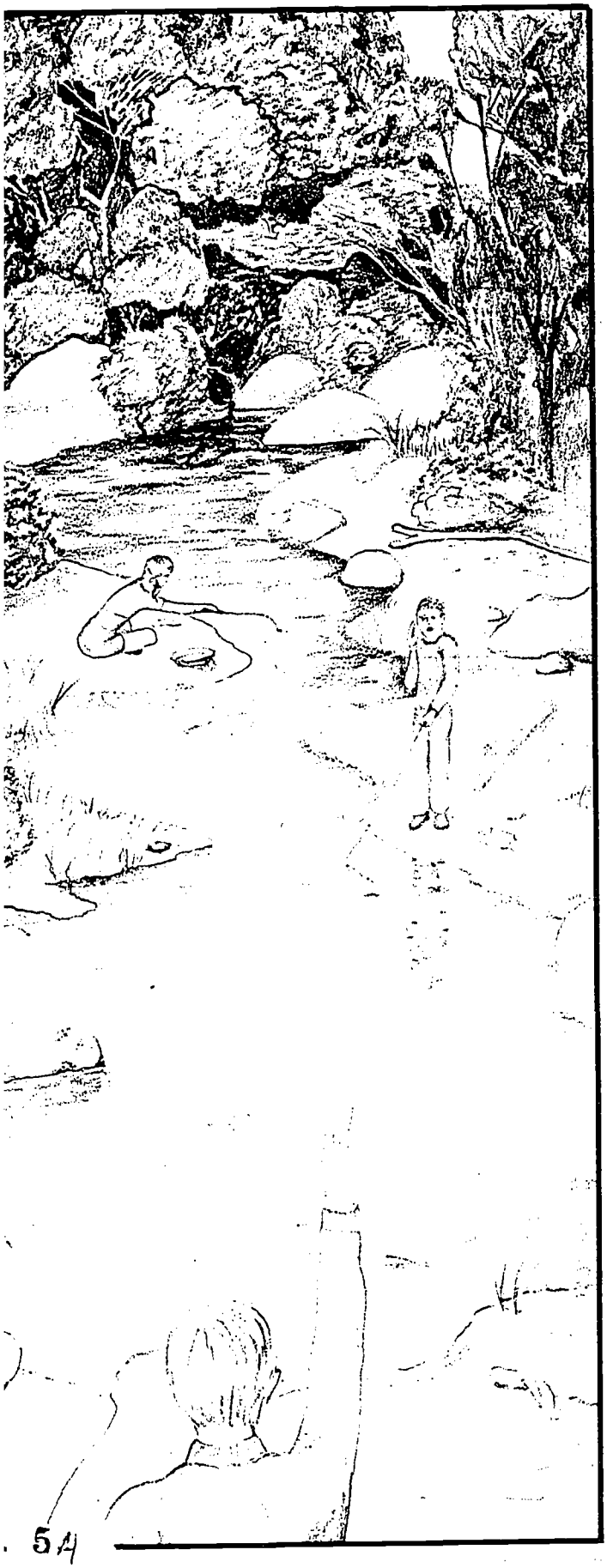

CONTEST HIGHLIGHTS

Gather to discuss contest highlights and discoveries. Ask the contest winner to describe his/her winning crawdad techniques.

- ☐ Did the crayfish prefer certain baits?
- ☐ Which trap designs were most successful? Why?
- ☐ Which fishing techniques worked the best?
- ☐ Where were the best fishing spots?
- ☐ How do crayfish move?
- ☐ How do the crayfish react when you try to pick them up?
- ☐ How do the crayfish react to each other?
- ☐ How does a crawdad eat? Where is its mouth?

FOLLOW THROUGH

Mark and Recapture. Discover if crawdads stay in the same area. Use a bottle of brightly colored nail polish to mark captured crayfish. Dry off their backs and apply a small spot of polish. Keep track of the number of crayfish that are marked and released. Hold another Crawdad Grab on a different day to see how many of the marked crawdads you can recapture.

FURTHER INVESTIGATIONS

	Set
Attract a Fish	*II*
Hopper Circus	*II*
Water Breathers	*II*
Animal Movement in Water	*I*

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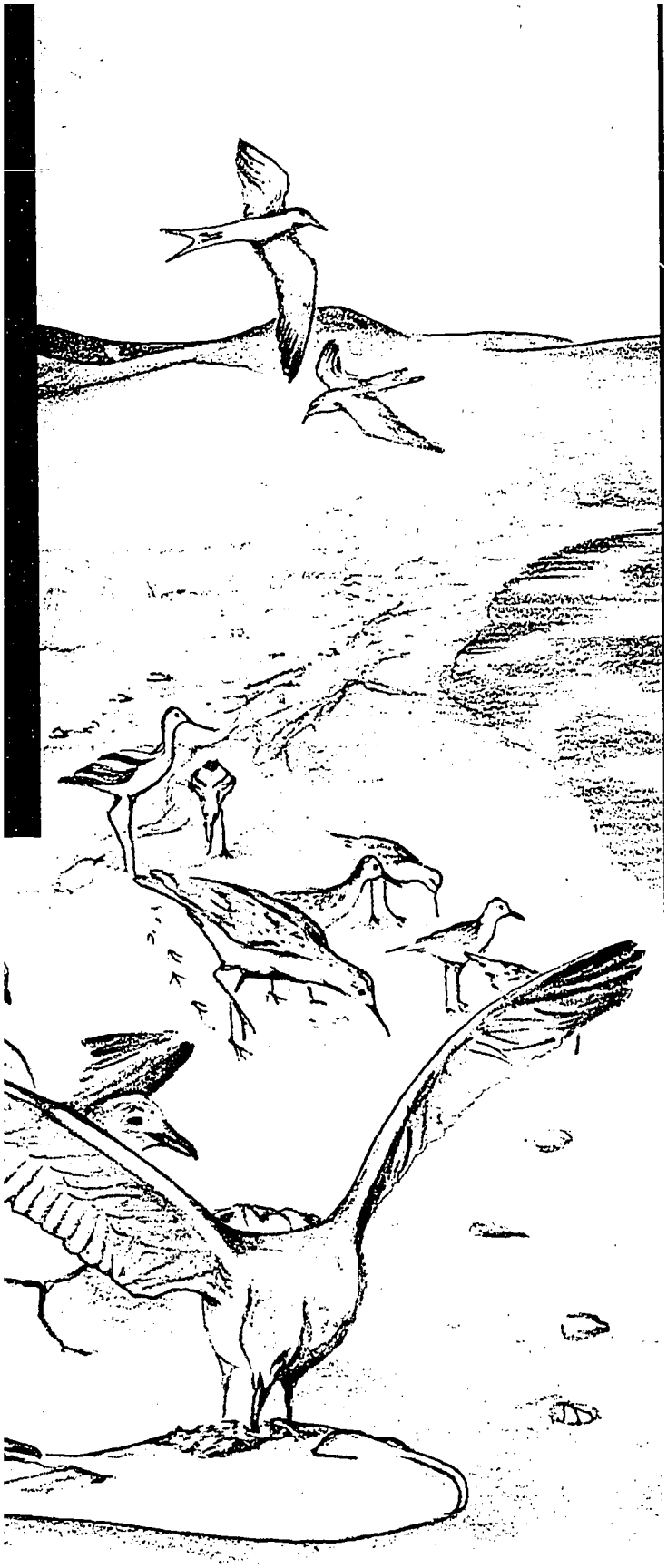

FOOD DETECTION

If time permits, ask the group how shorebirds might detect burrowing animals that live beneath the surface. Do they see, hear, feel, or smell them? Send the kids back into the site to use their senses to pinpoint the location of burrowing animals. **Hint:** Search for evidence of bird-feeding activity, e.g., tracks, droppings, probe holes, broken shells, etc. Hand out digging "beaks" for checking out selected locations.

FOLLOW THROUGH

1. Repeat the activity at a different site and compare the food sources found.
2. By watching different shorebirds' feeding behavior can you determine what they are eating?

WHAT TO DO NEXT

	Set
Crawdad Grab	II
Hopper Circus	II
Adaptation – Predator-Prey	I
Animal Movement in Water	I

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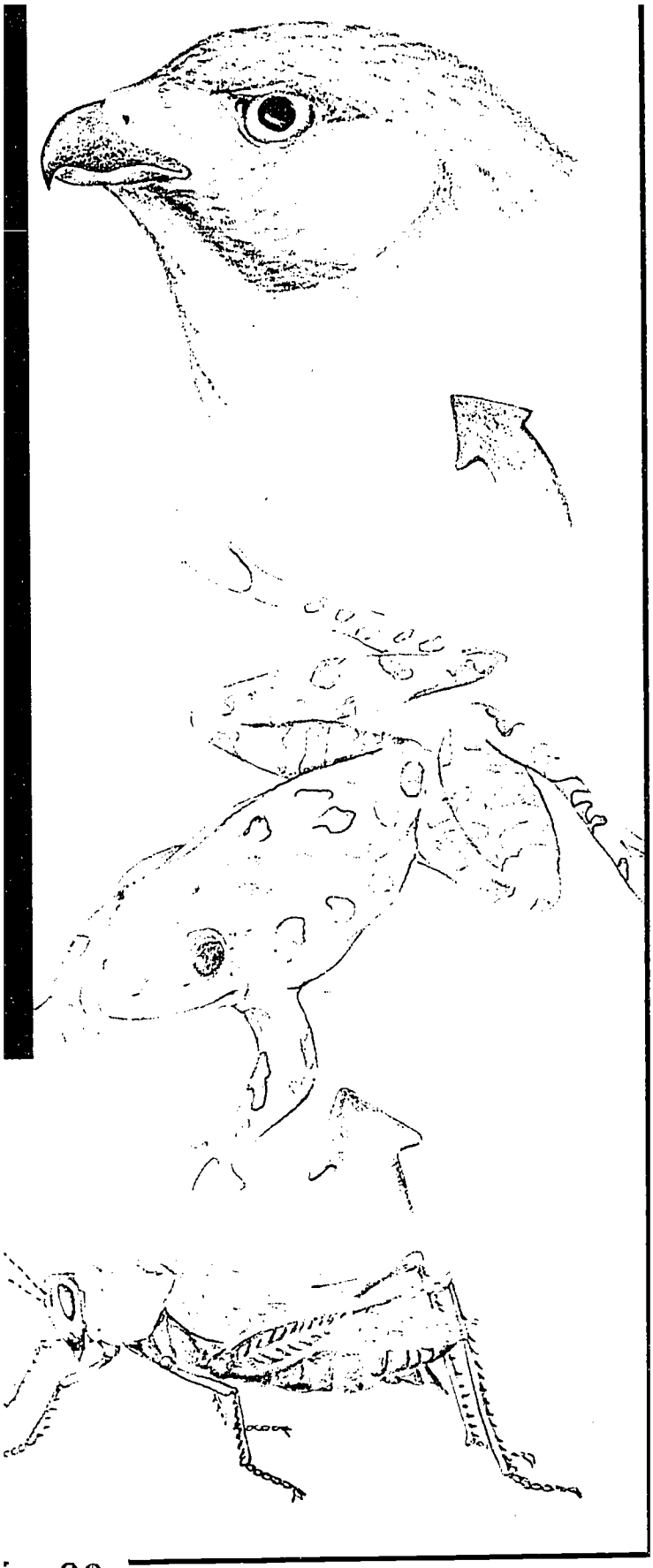

FOOD FOR THOUGHT

After each game, analyze the results. How many hoppers got a full stomach? How many frogs? The hawks? Encourage youngsters to compare game results after each rule change, and to comment on how the game "balance" compares with balance in the real world. In nature's balance, there are more plants than plant eaters and more plant eaters than animal eaters. You might wish to graphically represent the results on your data board.

☐ What would happen if there were only half as many popcorn plants? What would happen to the animal that depends on those plants?

☐ If there were no frogs, what would happen to the plant population? The hopper population? The hawk population?

☐ Do hawks need plants to survive? Explain!

☐ Can you describe some food chains that *you* are part of?

☐ Are there any plants or animals that are *not* part of any food chains?

MORE LINKS IN THE CHAIN

☐ Look for evidence of plants being used for food. Can you find the animals responsible? Make sun prints of the evidence you find. (See *Habitat Sun Prints*, Set I.)

☐ Find some ladybugs, or better yet, some ladybug larvae. Put them in with some aphids in a small container and observe. Describe the food chain they are part of.

WHAT TO DO NEXT

	Set
Attract a Fish	II
A Better Fly Trap	II
Flocking to Food	II
Gaming in the Outdoors	II

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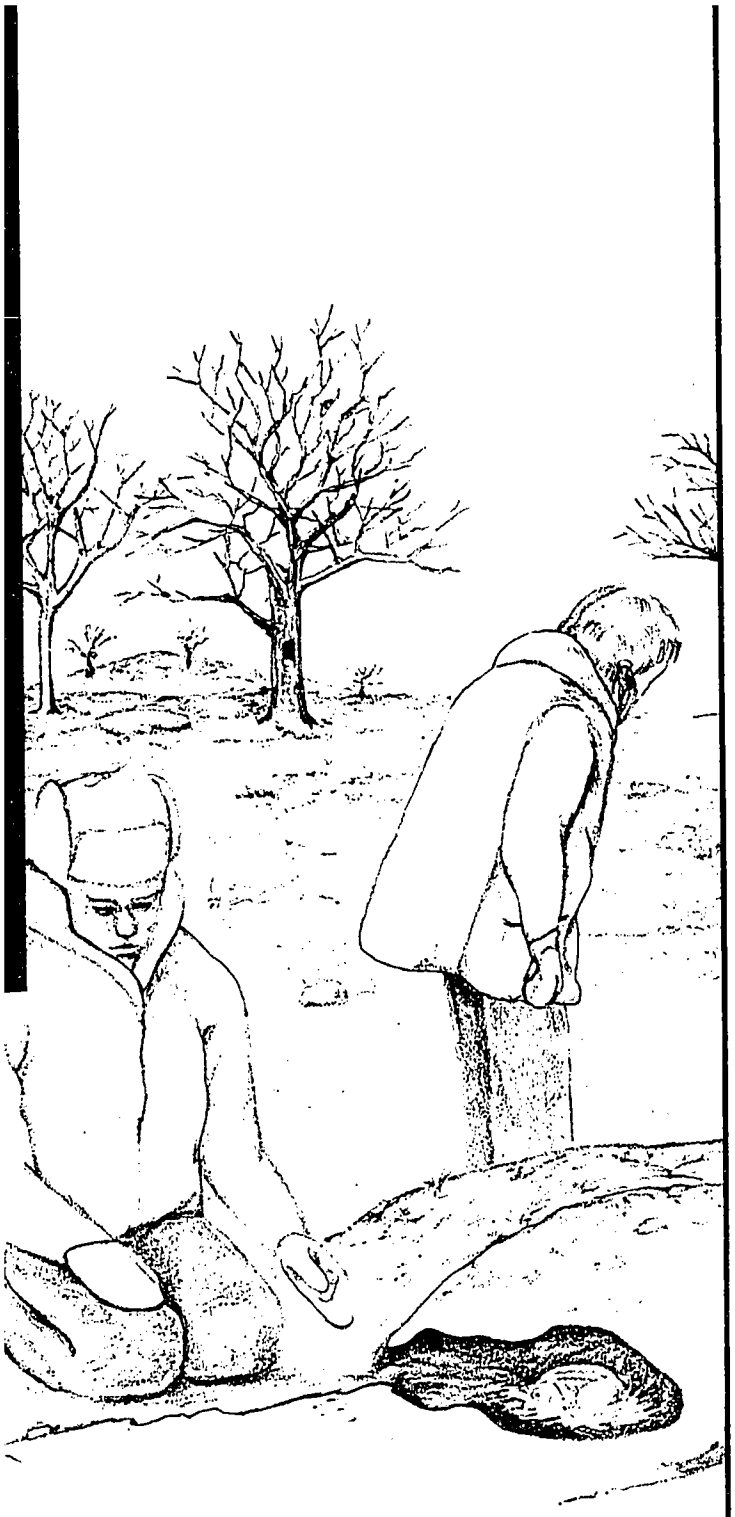

CHILLING THOUGHTS

☐ Why would a gelatin animal always eventually freeze in sub-freezing temperatures, but a rabbit would not?
☐ If you were stranded in a winter storm without a fire how could you keep from freezing?

FOLLOW THROUGH

1. Provide insulating materials such as feathers, wool, paper, and man-made insulators and repeat the activity.
2. How does constant stirring of the gelatin affect its gelling time?
3. Using the same containers, double the volume of liquid gelatin. What happens? After experimenting with the gelling time of different volumes of gelatin, ask the kids if they think small animals or large animals might have a more difficult time of conserving their heat.

WHAT TO DO NEXT

	Set
Birdfeeder	II
Sensory Hi-Lo Hunt	II
Who Goes There?	I

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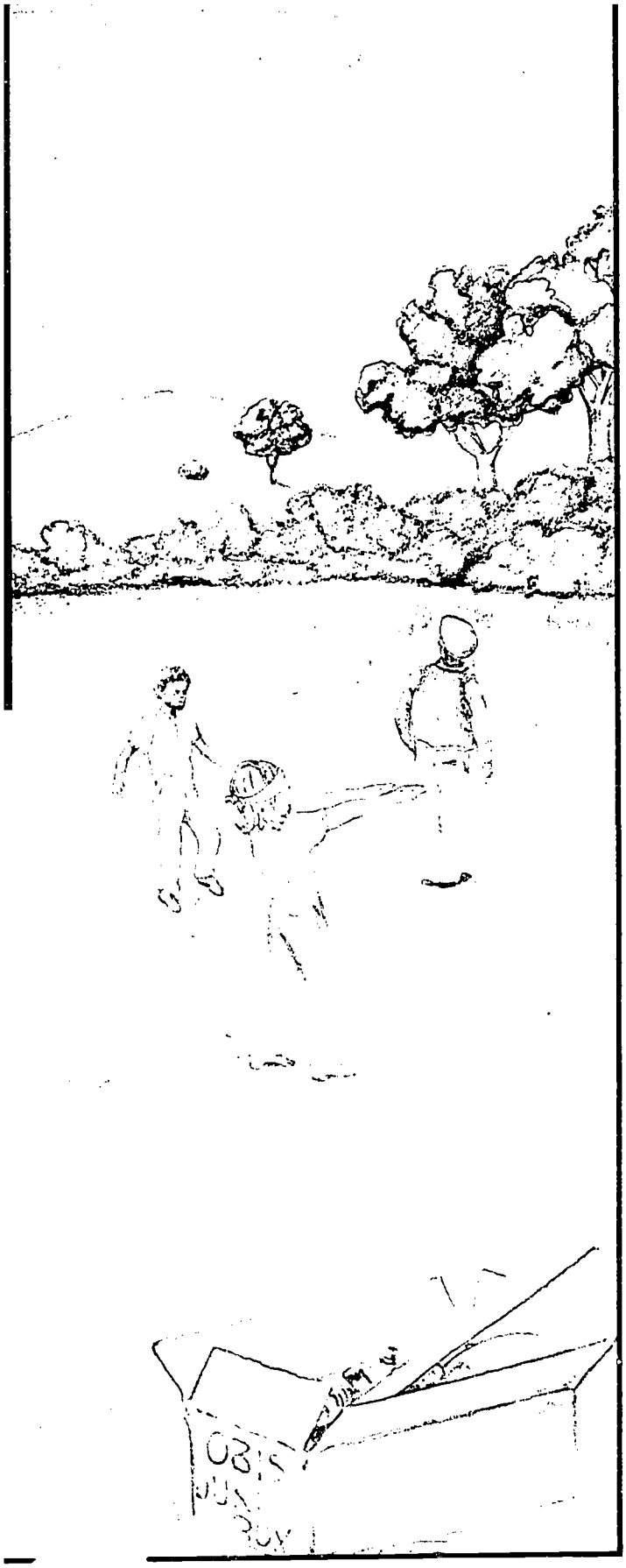
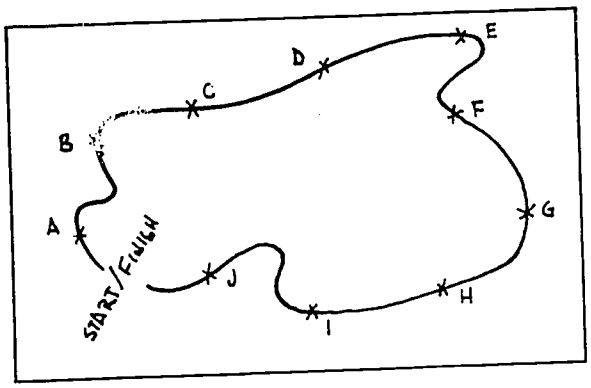


2. Along the path, place natural objects in areas where they do not belong. For instance, place an apple in a berry bush, berries in an oak seedling, an oak leaf in an elm tree, or make a damp area on dry ground in bright sunlight.
3. Prepare score cards by outlining the trail on index cards and indicating the location of the lettered intervals.



ACTION

Play the game.

1. Tell the group you have made some changes in the area. If the kids know the area well, they will be able to detect the objects that are out of place. Give them one example.
2. Tell the group that only two to three hunters can follow the trail at a time. When a youngster wants to hunt, he or she obtains a score card and pencil from the leader and waits for the leader's OK to start. Explain that each hunter records on the score card the number of out-of-place items in each of the lettered intervals. All discoveries should be kept secret until the end of the hunt.
3. When everyone has completed the hunt, ask for the number of out-of-place items discovered, and compare score cards.
4. As a group, walk the circular path again and have the hunters point out the items they found. Point out any items the youngsters missed.

Play the game again.

Divide the group into two teams. Have each team make a trail of out-of-place objects for the other team. Provide natural objects or have the teams collect them from surrounding areas.

FOLLOW THROUGH

In any natural outdoor setting, there are curious, unexpected things to find. Some examples are a mound of soil, a piece of litter, one defoliated bush, footprints, or tracks. A good outdoor hunter can use these curiosities as clues to the interactions that have occurred in the area, whether they be gophers digging burrows or insects eating leaves on a bush. Have the group hunt for these natural things in their activity area. What do these curious clues tell you?

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Outdoor gam
can also be e
youngsters to
their observa
contains two
youngsters w
environmenta
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Any game is
players actu
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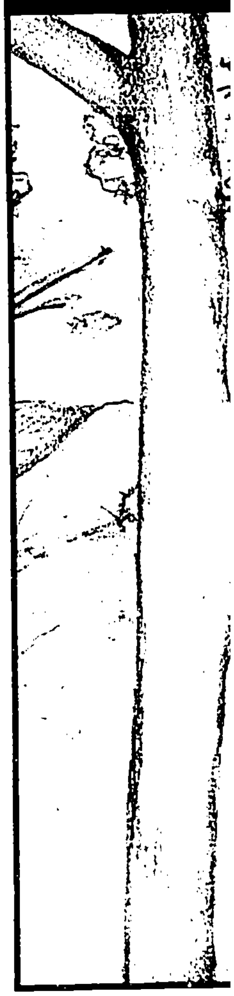

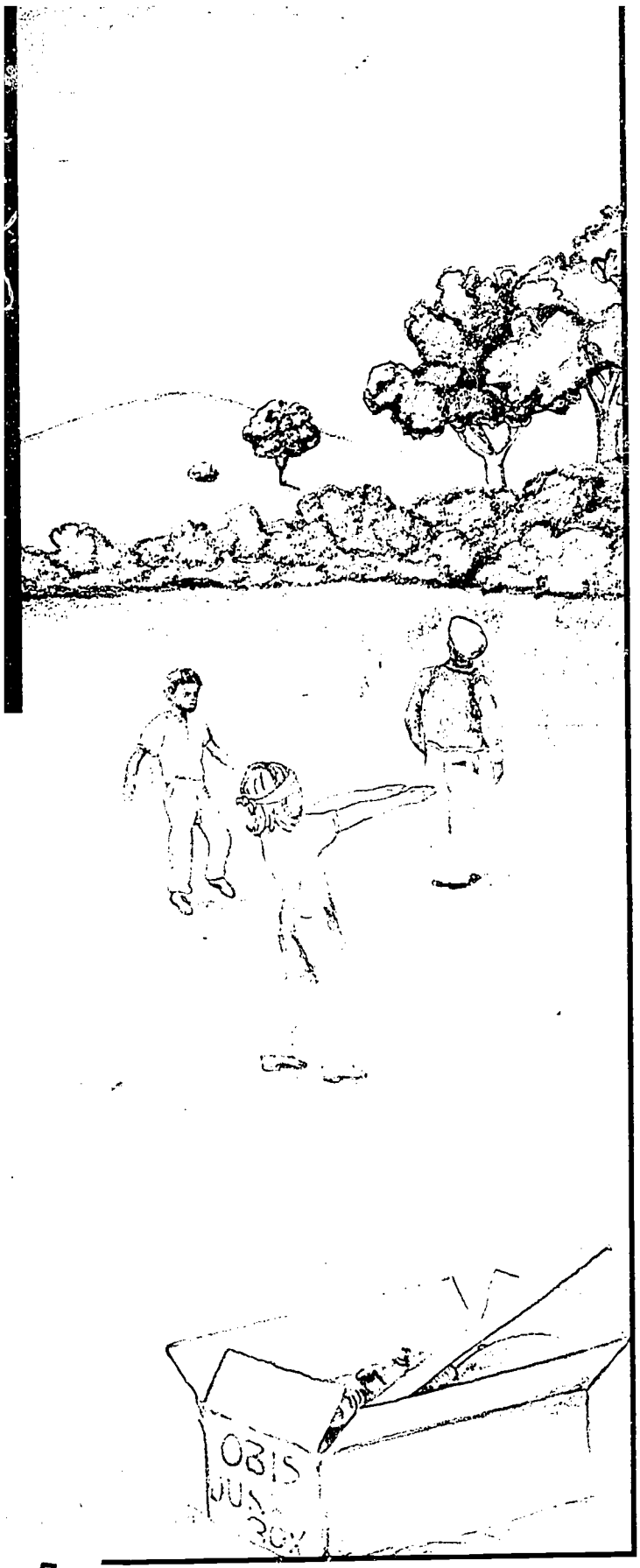

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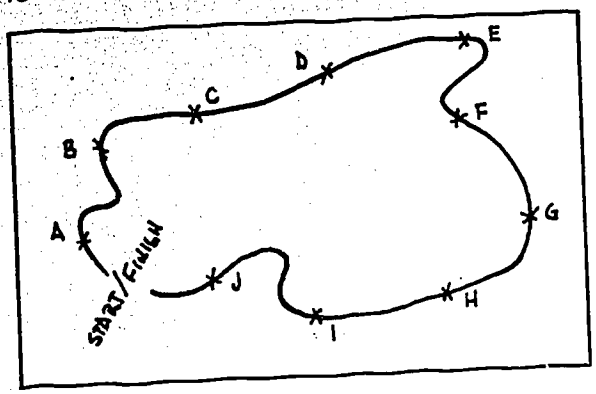

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Divide the group into two teams. Have each team make a trail of out-of-place objects for the other team. Provide natural objects or have the teams collect them from surrounding areas.

FOLLOW THROUGH

In any natural outdoor setting, there are curious, unexpected things to find. Some examples are a mound of soil, a piece of litter, one defoliated bush, footprints, or tracks. A good outdoor hunter can use these curiosities as clues to the interactions that have occurred in the area, whether they be gophers digging burrows or insects eating leaves on a bush. Have the group hunt for these natural things in their activity area. What do these curious clues tell you?

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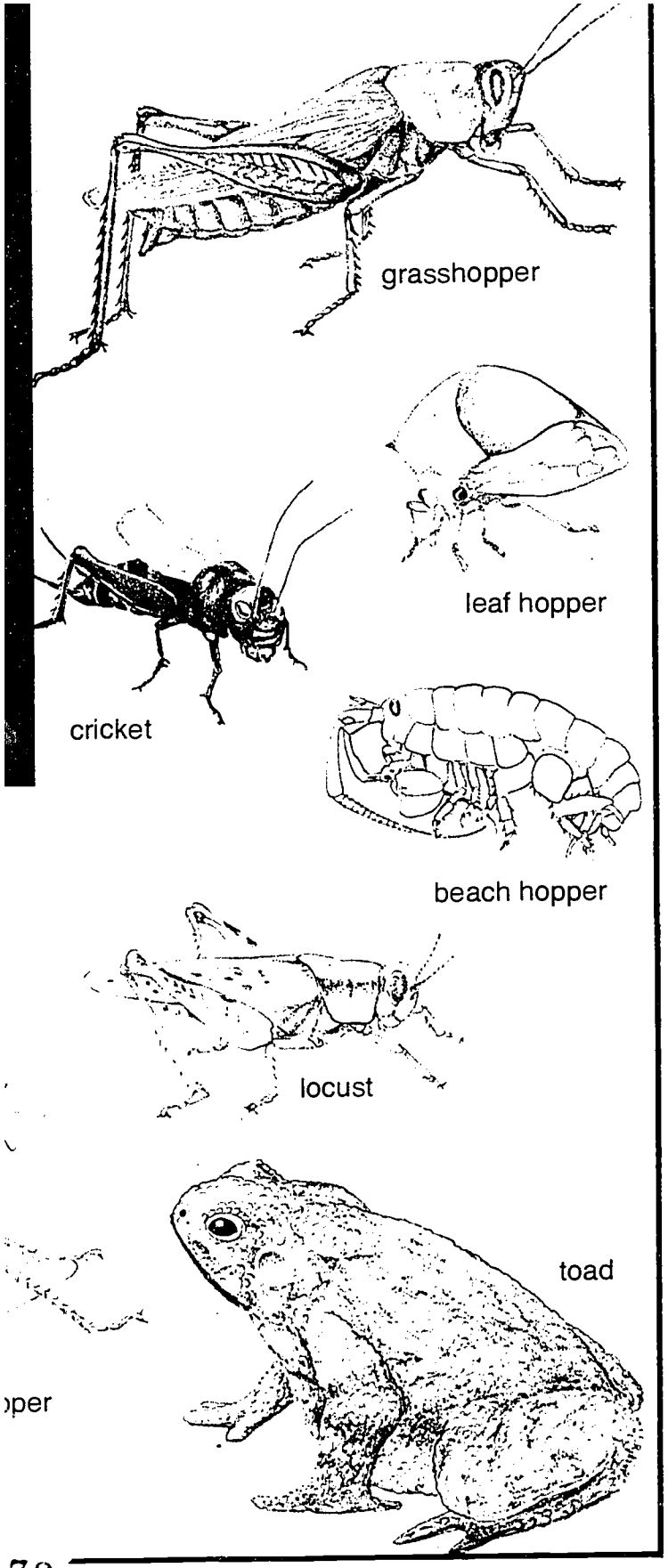
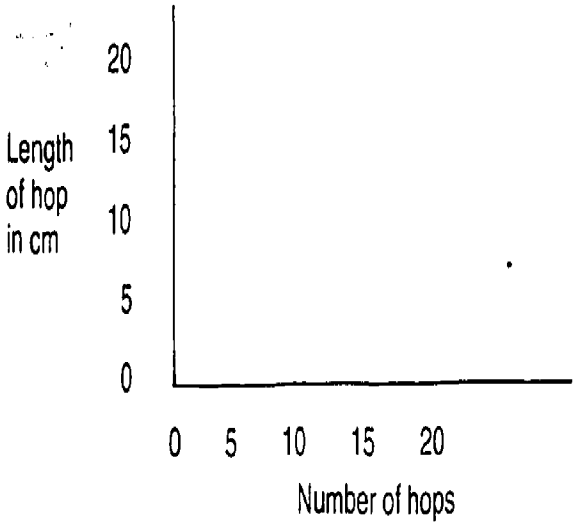

grasshopper
leaf hopper
cricket
beach hopper
locust
toad

HOPPER CIRCUS
Side-Show Card #1

Outdoor Biology
Instructional Strategies

Distance. Does the distance a hopper hops (in one hop) change as it hops more and more?



HOPPER CIRCUS
Side-Show Card #2

Outdoor Biology
Instructional Strategies

Slope. Does your hopper tend to go uphill, across the hill, or downhill when placed on a slope?

Test three or four animals.

HOPPER CIRCUS
Side-Show Card #3

Outdoor Biology
Instructional Strategies

Removal. Find a way to get hoppers out of their hiding places without touching the hoppers or their hiding places with any part of your body. Singing, crying, hot breath, water, ice, etc., are OK to try.

What works?

HOPPER CIRCUS
Side-Show Card #4

Outdoor Biology
Instructional Strategies

Sight. Do the hoppers seem to have good vision? How do they react to quick movements? Slow movements? Close movements? Distant movements?

Try several hoppers. Be as quiet as possible.

HOPPER CIRCUS
Side-Show Card #5

Outdoor Biology Instructional Strategies

Light. Do the hoppers seem to hop better in sunlight or shade?

Test several hoppers to find out.

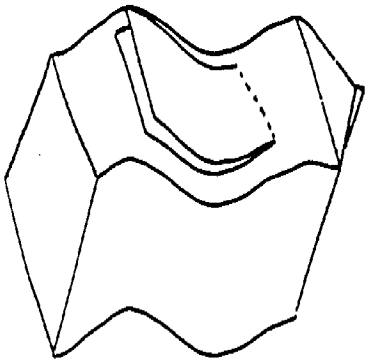
HOPPER CIRCUS
Side-Show Card #6

Outdoor Biology Instructional Strategies

For small hoppers only!

Attraction. Put different materials into a hinged milk carton and add some hoppers. To which materials do the hoppers go? Repeat several times.

What is there about these materials that seem to attract the hoppers?

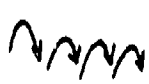


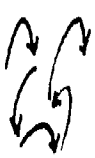
HOPPER CIRCUS
Side-Show Card #7

Outdoor Biology Instructional Strategies

Direction. When a hopper makes a series of jumps, is each jump made in the same direction or in a variety of directions? Test several hoppers to find out.

This or this or ?



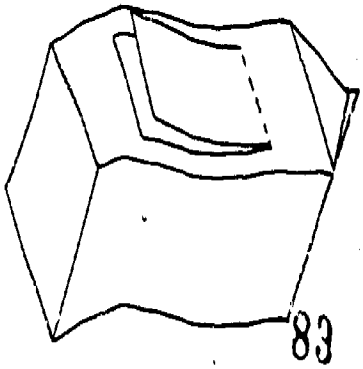


HOPPER CIRCUS
Side-Show Card #8

Outdoor Biology Instructional Strategies

Flashing light. Get a hopper "light-response tester" from the leader. Put some hoppers into the milk-carton tester and close the lid. Keep it closed for a minute and then open it quickly to see if the hoppers react to the light.

What do they do?



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Side-Show Card #1

Outdoor Biology Instructional Strategies

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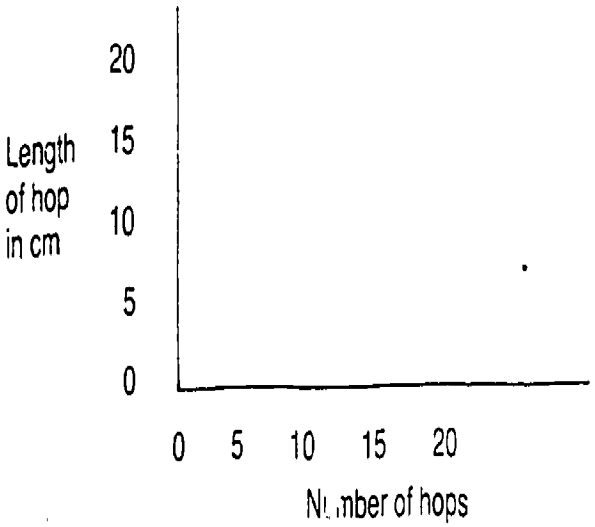

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Outdoor Biology Instructional Strategies

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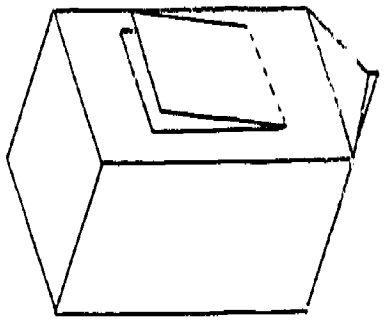
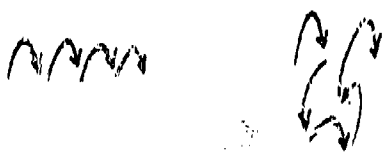


HOPPER CIRCUS
Side-Show Card #7

Outdoor Biology Instructional Strategies

Direction. When a hopper makes a series of jumps, is each jump made in the same direction or in a variety of directions? Test ten hoppers to find out.

This or this or ?



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Side-Show Card #8

Outdoor Biology Instructional Strategies

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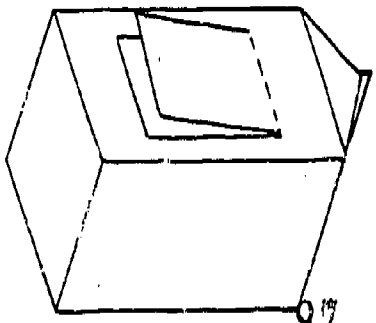
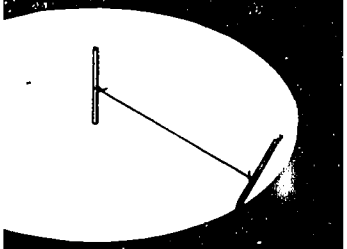


PPER RACE

e Race Course. Try to
course with smooth,
dirt or sand in full sunligh
one meter in diameter fo
s, two meters for cricket
rogs, and grasshoppers.
our meters for large
and frogs. Take a string
a of your chosen diamete
end around a different st
o like a compass to draw
Mark the center point.



hen fifteen to twenty
in in the time for the
e participants together a
main event. The Hoppe
ce will give the participan
se what they have learne
s.

ure: The track will run
r of the circle to its edge
hoppers at a time. (It is
o track of more than two
the race, place both
center of the circle. Sta
soon as one hopper begi
top the timing as soon a
r reaches the edge of th
No prodding or touching
uring the race allowed!
between the two fastest
termine the overall winne
races as time and interes

CIRCUS TALK (Optional)

You may want to discuss with your participants what they learned about hoppers. You can use the race results and side-show cards to start the discussion. If you were going to breed a grand champion hopper what qualities would you look for in the parent hoppers (size, length of jump)? How far can they hop? How can you stimulate hoppers to hop without touching them? Do hoppers swim? And so on.

FOLLOW THROUGH

1. Repeat the activity with a different animal.
2. Using *Bean Bugs* (Set I) as a guide, challenge your group to take a population census of the hoppers in your activity site.

WHAT TO DO NEXT

	Set
Ants	*Individual*
Attract a Fish	*II*
Water Breathers	*II*
Bean Bugs	*I*

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Lawrence Hall of Science
University of California
Berkeley, California

Supported by a Grant from the National Science Foundation

LICHEN LOOKING
Action Card #1

Outdoor Biology Instructional Strategies

Lichen Colors

HOW MANY DIFFERENT COLORED LICHENS CAN YOU FIND?
Each time you discover a lichen of a new color, break off a tiny piece of the lichen no larger than this size ⊜ and tape it to this card.

MATERIALS: tape

LICHEN LOOKING
Action Card #2

Outdoor Biology Instructional Strategies

Lichen Shapes

HOW MANY DIFFERENT SHAPES OF LICHENS CAN YOU FIND?
Place a piece of wax paper over each different shape and trace its outline.

MATERIALS: wax paper, pen

LICHEN LOOKING
Action Card #3

Outdoor Biology Instructional Strategies

Lichen Critters

WHAT KINDS OF ANIMALS DO YOU FIND ON THE LICHENS?
Each time you find an animal, place it in the bug box or plastic bag for observation. What do you think the animal is doing on the lichen?

MATERIALS: bug box or bag

LICHEN LOOKING
Action Card #4

Outdoor Biology Instructional Strategies

Tree Lichens

WHICH TREES HAVE LICHENS AND WHICH DON'T?
Collect a leaf from each tree that has lichens. Keep these leaves in the "LICHEN" bag.

Collect a leaf from each tree that does not have lichens. Keep these leaves in the "NO LICHENS" bag.

What features of some trees might prevent lichen growth on the bark?

MATERIALS: 2 LABELED BAGS

LICHEN LOOKING
Action Card #5a

Outdoor Biology
Instructional Strategies

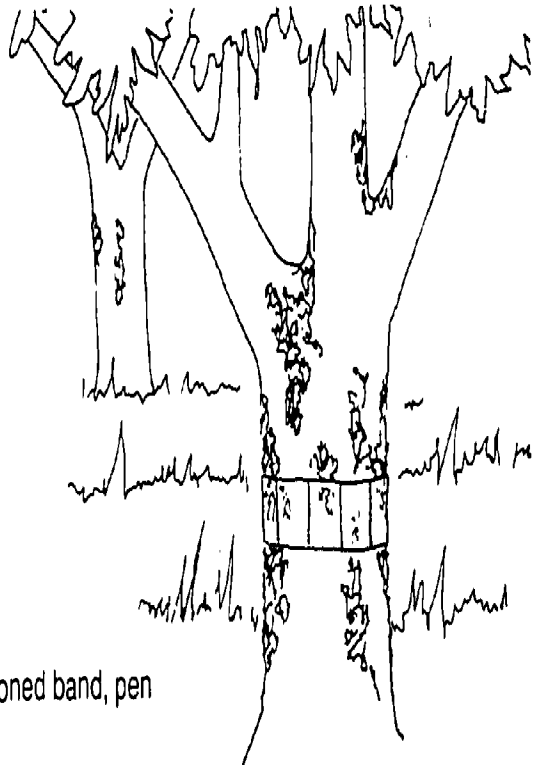
For Plentiful Lichen Populations

HOW MANY LICHENS?
Place the wax-paper band around the trunk of a tree (or around a large rock) so the band end labeled "N" is on the NORTH side of the tree or rock. How many lichens are there in each band section? Use this card to keep score.

10	9	8	7	6	5	4	3	2	1 N

10	9	8	7	6	5	4	3	2	1 N

Try another tree. Are the lichens evenly spaced on the tree or do they grow mainly in certain areas? What might cause this? Do the lichens seem to be clustered on the west, east, north, or south side of the tree?



MATERIALS: sectioned band, pen
Optional: compass

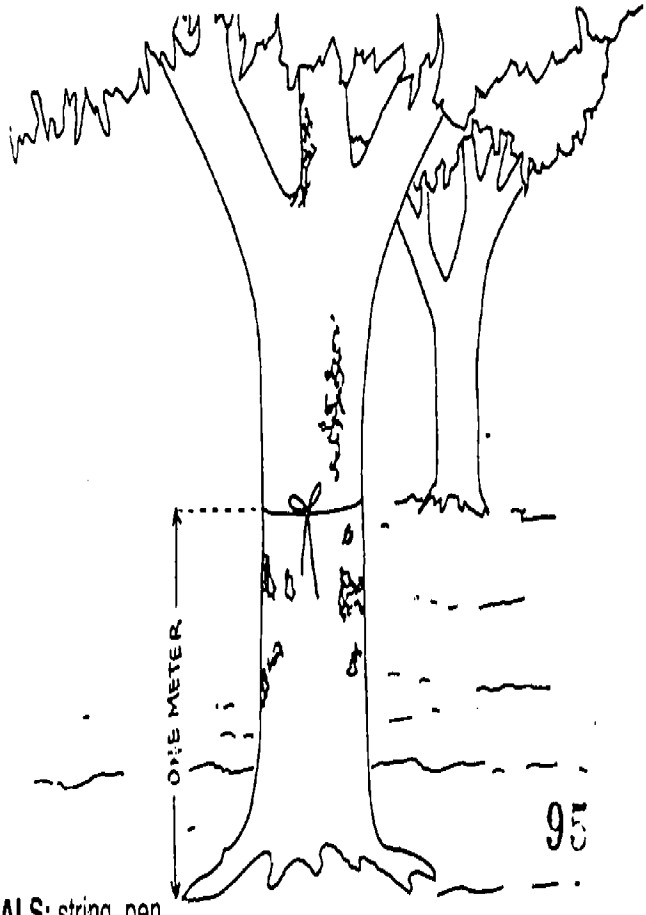
LICHEN LOOKING
Action Card #5b

Outdoor Biology
Instructional Strategies

For Sparse Lichen Populations

HOW MANY LICHENS?
Select several trees (or large rocks) with lichens. Tie the marked string around the trunk of one of them, one meter from the base of the tree. You can use the marked-off string to measure one meter. The one-meter area merely limits your counting area. How many lichens are there below the string? Try this on several other trees (or rocks) and compare results. Use this card to keep score.

Rock or tree | Rock or tree | Rock or tree



MATERIALS: string, pen

LICHEN LOOKING

ACTION

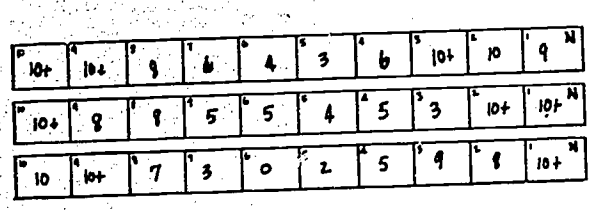
1. Explain to the participants that they are going Lichen Looking.
2. Describe the boundaries of the activity site.
3. Point out two or three different kinds of lichens and challenge the youngsters to find all the different places where lichens live in the site. Caution the youngsters to be gentle because lichens develop so slowly that any damage to them would be long lasting. Divide the group into teams of two and send them off.
4. After five minutes, call the teams back to report where they found lichens
5. For the next challenge, each team selects one tree, rock, or other object for investigation. Allow one minute for tree and rock selection. If territorial battles ensue, assign trees or let two groups work on the same tree. Each team will have 1½ minutes to stick a flag next to each lichen the youngsters can find and reach on their tree or rock. Give each team an envelope of 20 flags. Make masking tape available for attaching pins to rocks. When the teams are ready, give the signal to START. After 1½ minutes, give the signal to STOP. Assemble the group and ask how many lichens each team pinned. Were there any plants on the trees other than lichens? Point out any thick, moist green mounds of moss that might be mistaken for lichens. If you look closely you will discover that moss plants have tiny leafy stalks although they look like green velvet mounds. Do not forget to remove all flags.

6 Now for some serious Lichen Looking! Display five stacks of action cards (Each stack represents a different action) Pass out a bag of materials to each team Each bag contains the materials necessary for all the investigations Encourage the teams to select action cards and start their investigations

7 Wander from team to team offering assistance if needed and allowing the youngsters to share their discoveries with you When a team is finished with one card encourage the youngsters to try others

LOOKING FURTHER

When most teams have finished the investigations, assemble the group. Encourage the teams to share their discoveries. One way to initiate discussion is to ask the teams to compare their results of Action Card 5a. Arrange the sectional bands in a column and ask the group to look for patterns. Do lichens seem to grow on certain sides of trees and rocks? Why might this be?



LICHEN LOOKING REVISITED

1. Find a lichen that is dry and brittle. Add water to it and see what happens in a few hours, in a few days. Is there any change?
2. Be on the lookout for lichens wherever you go. Where do they grow?
3. Some Air Quality Control Councils use lichens as indicators of air pollution. Check with your local Environmental Council and see if it has such a program. Perhaps your group could assist in the survey.

WHAT TO DO NEXT

	Set
Plant Patterns	II
Animal Diversity	II
Invent a Plant	I
Invent an Animal	I

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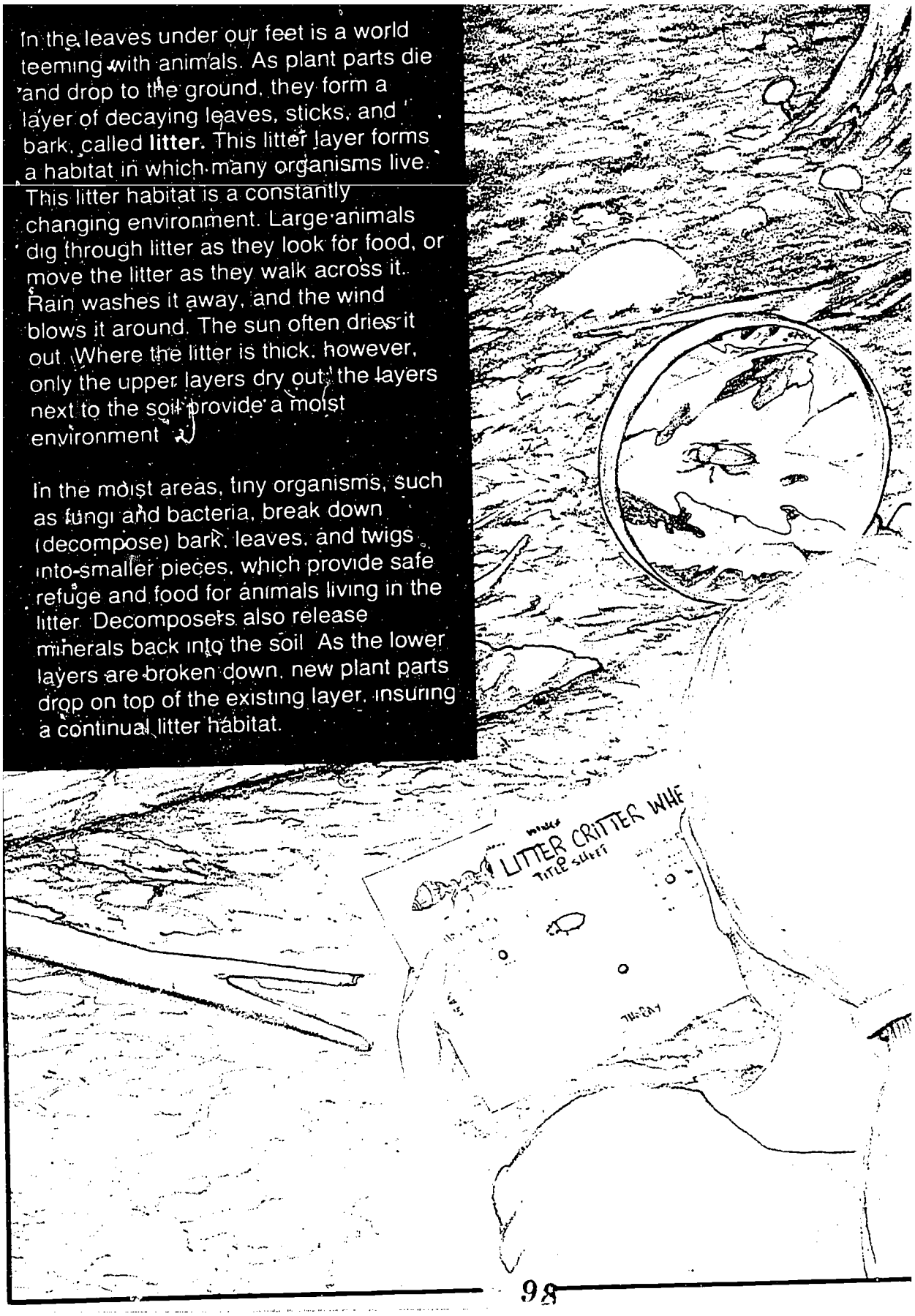
Lawrence Hall of Science
University of California
Berkeley California

Supported by a Grant from the National Science Foundation

In the leaves under our feet is a world teeming with animals. As plant parts die and drop to the ground, they form a layer of decaying leaves, sticks, and bark, called **litter**. This litter layer forms a habitat in which many organisms live.

This litter habitat is a constantly changing environment. Large animals dig through litter as they look for food, or move the litter as they walk across it. Rain washes it away, and the wind blows it around. The sun often dries it out. Where the litter is thick, however, only the upper layers dry out; the layers next to the soil provide a moist environment.

In the moist areas, tiny organisms, such as fungi and bacteria, break down (decompose) bark, leaves, and twigs into smaller pieces, which provide safe refuge and food for animals living in the litter. Decomposers also release minerals back into the soil. As the lower layers are broken down, new plant parts drop on top of the existing layer, insuring a continual litter habitat.



Animals that live in litter are generally small, such as insects, slugs, spiders and salamanders. Small size allows these animals to crawl into tiny crevices between decomposing plant and animal matter. The small size also makes these animals easy to overlook.

DISCOVER THE DIFFERENT KINDS OF ORGANISMS THAT LIVE IN A NATURAL LITTER HABITAT

MATERIALS

For each team of two:

To find and describe litter animals

- 2 plastic cups
- 1 bug box or magnifying lens
- 1 3" x 5" card (to scoop up animals)
- 1 Litter Critter Wheel
- 1 sack or bike bag (to hold team materials)

To record animals

Method 1 (Tracing)

- 1 pencil
- crayons
- 2 Record Cards (Reproduce on onionskin paper with a ditto machine)

Method 2

- 1 pencil
- crayons
- 1 Litter-Critter Body-Parts Sheet
- transparent tape
- scissors

For the group:

- several white-bottomed containers, dishpans, or milk-carton halves (cut lengthwise)
- several milk-carton Litter Shakers (See the equipment card in the *OBIS Toolbox* folio.)
- extra Record Cards and Body-Parts sheets

Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

See the inserts in this folio.

Outdoor Biology Instructional Strategies

Equipment Card
LITTER CRITTER WHEEL

With this device, youngsters become familiar with body parts of animals in the litter and develop observational skills. It takes about thirty minutes to assemble one wheel after all the materials are duplicated and gathered. Once assembled, the wheels can be used repeatedly.

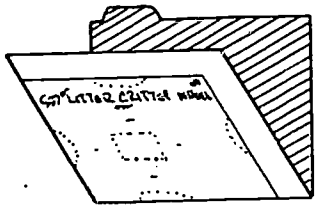
MATERIALS FOR ONE WHEEL:

1 8½" x 11" manila file folder
1 duplicated "Litter Critter Wheel Title Sheet" (xeroxed or dittoed)
1 set of 4 wheels (4 overhead transparencies: head, thorax, abdomen, wings)*
4 round-head paper fasteners
1 pair of scissors or single-edged razor blade
• rubber cement or glue

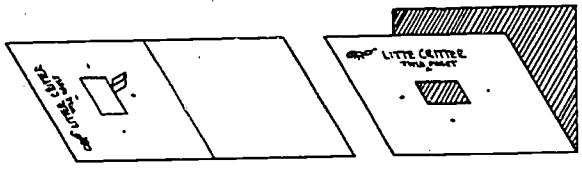
*You can make these transparencies from the masters provided or order them from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

To Prepare the Wheel Folder:

1. Glue the Title Sheet to the file folder, lining up the bottom of the sheet with the folder as shown.

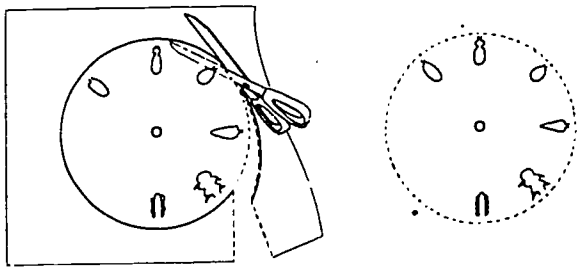


Reduce the folder to the size of the Title Sheet by cutting around the edge of the sheet. The Title Sheet accurately positions the window and also the paper fasteners for the wheel centers.
2. Open the folder and lay it flat with the Title Sheet facing up. With a single-edged razor blade, cut out the window in the Title Sheet, also cutting through the side of the folder on which the sheet is glued.

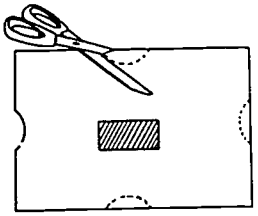


Make a tiny slit at each paper-fastener location through the Title Sheet and the one side of the folder. The slit allows you to push the paper fastener through the sheet more easily.

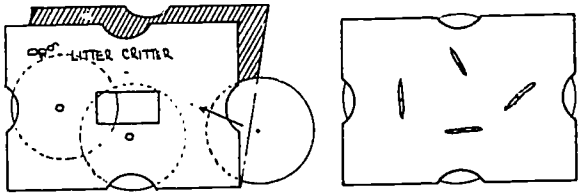
3. Cut out the transparent body wheels *inside* the black outline so that edge of the wheel is clear.



In the center of each wheel, cut a hole the width of the paper fastener so that the wheel will turn freely on the fastener, being careful not to make the hole too big.
4. Cut out the crescent-shaped pieces at the top, bottom, and two sides of the Title Sheet and file folder. These cuts should be made through *both* sides of the folder so the wheels can be turned easily.



5. Use the Title Sheet to guide you in positioning each wheel; put the thorax wheel in first and the wing wheel in last. Place each wheel in the folder and lock it in place with a paper fastener through the center. The paper fasteners should go through both sides of the folder.



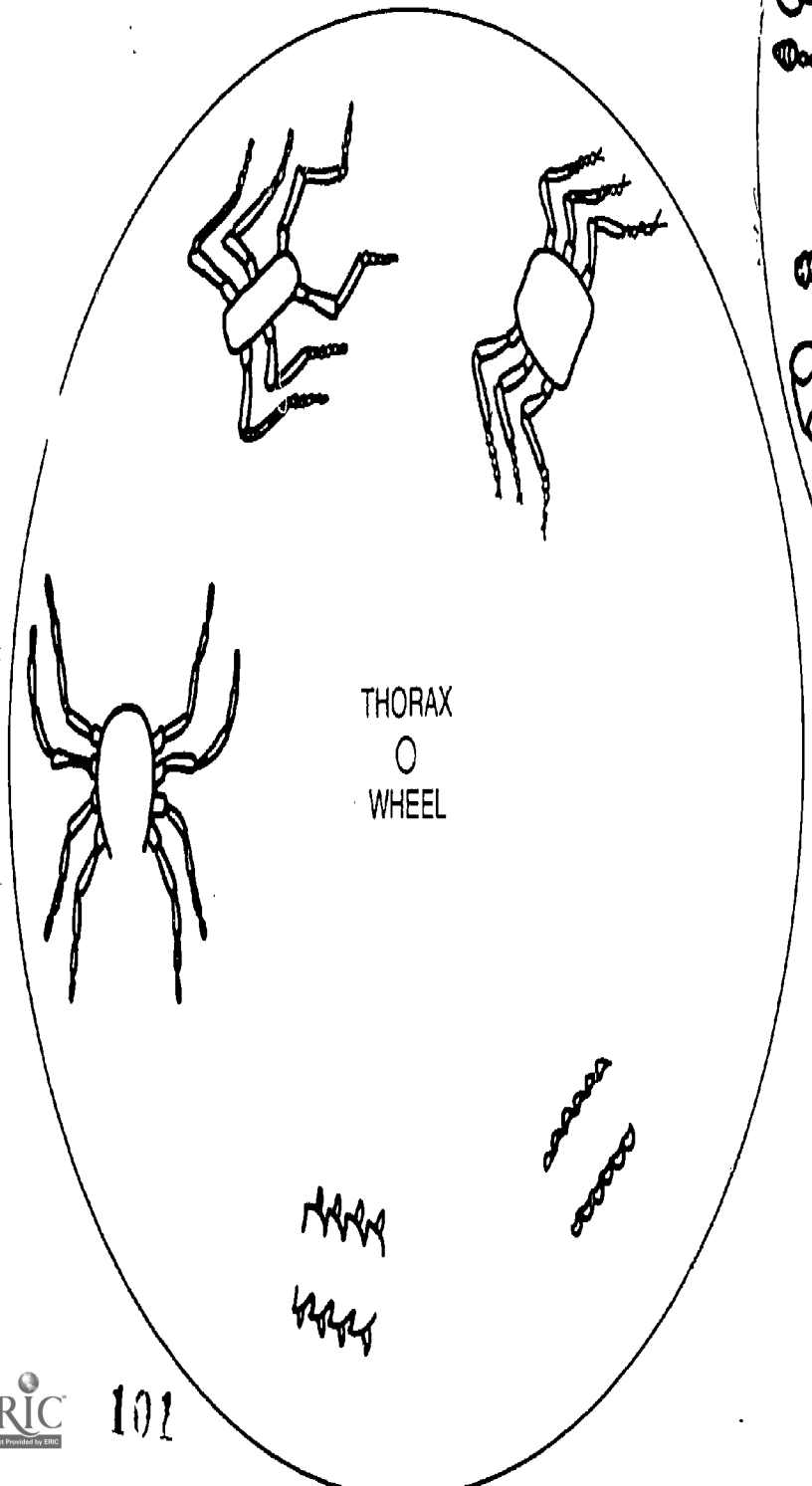
6. Your wheel folder is now complete. Each body-parts wheel should turn freely on its fastener and the body parts should line up in the window so you can recreate animals of different shapes.

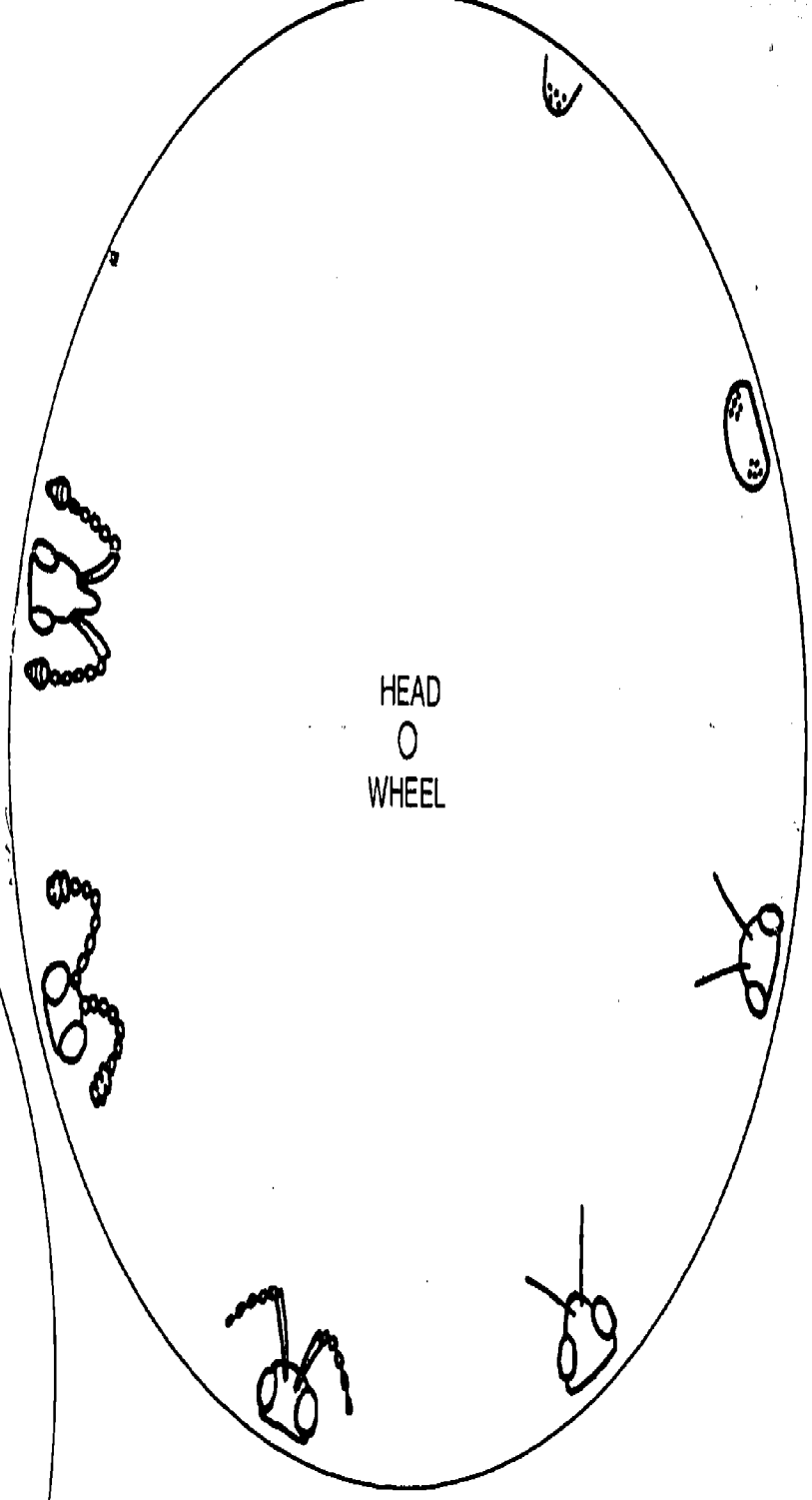
To Use Your Wheel:

1. Find an animal and look at it closely.
2. Try to recreate your animal by turning each wheel until the best generalized body part appears in the window. You probably will not be able to find the exact body part, so choose the part that most closely resembles your animal's body part.
Note: If, in your area, you consistently find animals whose body parts cannot be found on these wheels, draw in additional body parts on the open spaces on each wheel. The best method for permanently including your own drawings is to draw them on the master wheel or a xerox of the wheel with pencil or black ink. Then make a new transparent wheel to put inside the folder.
3. You can record your animal by either tracing it on a Record Card, or by cutting out appropriate body parts from the Litter-Critter Body-Parts Sheet and taping them to a Record Card. Modify the generalized body parts with pencil and crayons to more accurately represent your animal.

THERMOFAX MASTER, CARD 1
HEAD AND THORAX WHEELS

Directions: Duplicate these wheels onto an overhead transparency using a thermofax machine or any similar infrared, thermal transparency maker or copy machine. A set of four thermofax transparency wheels is available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.





LITTER-CRITTERS BODY-PARTS SHEET

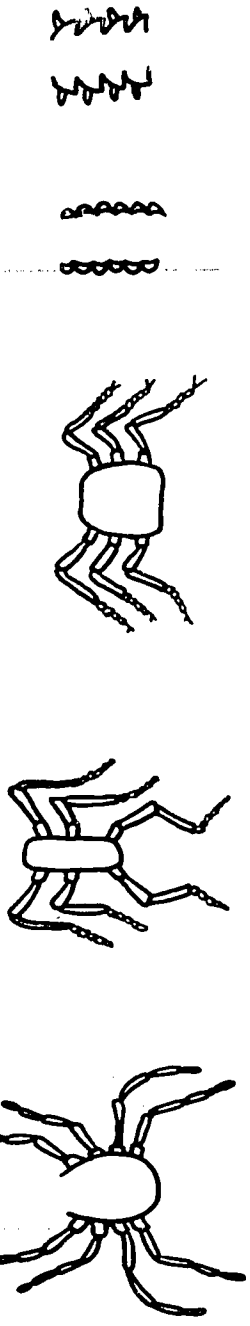
Outdoor Biology Instructional Strategies

(Use with Recording Method 2.)

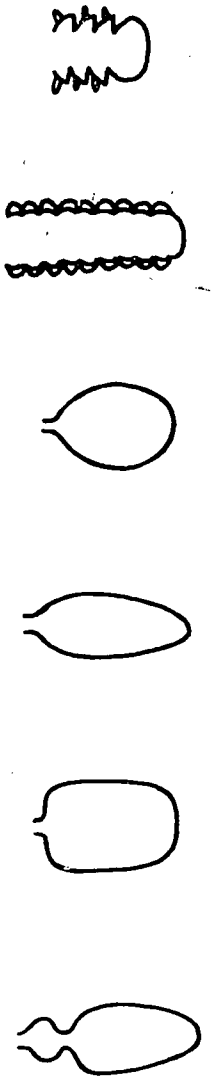
Make a record of each litter animal by cutting out the appropriate body part you used to describe the animal on the Litter Critter Wheel. Tape the body parts to your Record Card.

HEAD

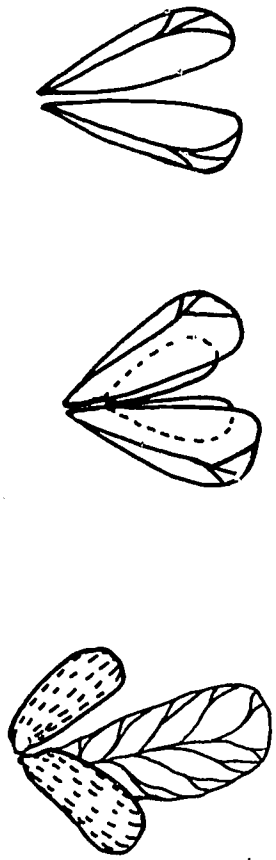
THORAX

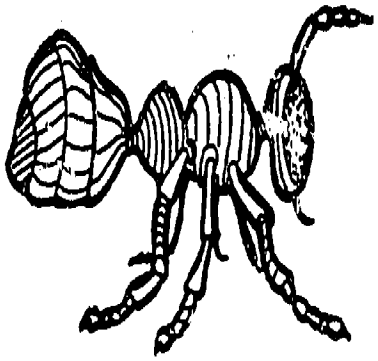


ABDOMEN



WINGS





WINGS

Outdoor Biology Instructional Strategies

LITTER CRITTER WHEELS

TITLE SHEET

HEAD

ABDOMEN

THORAX

How to use wheel:

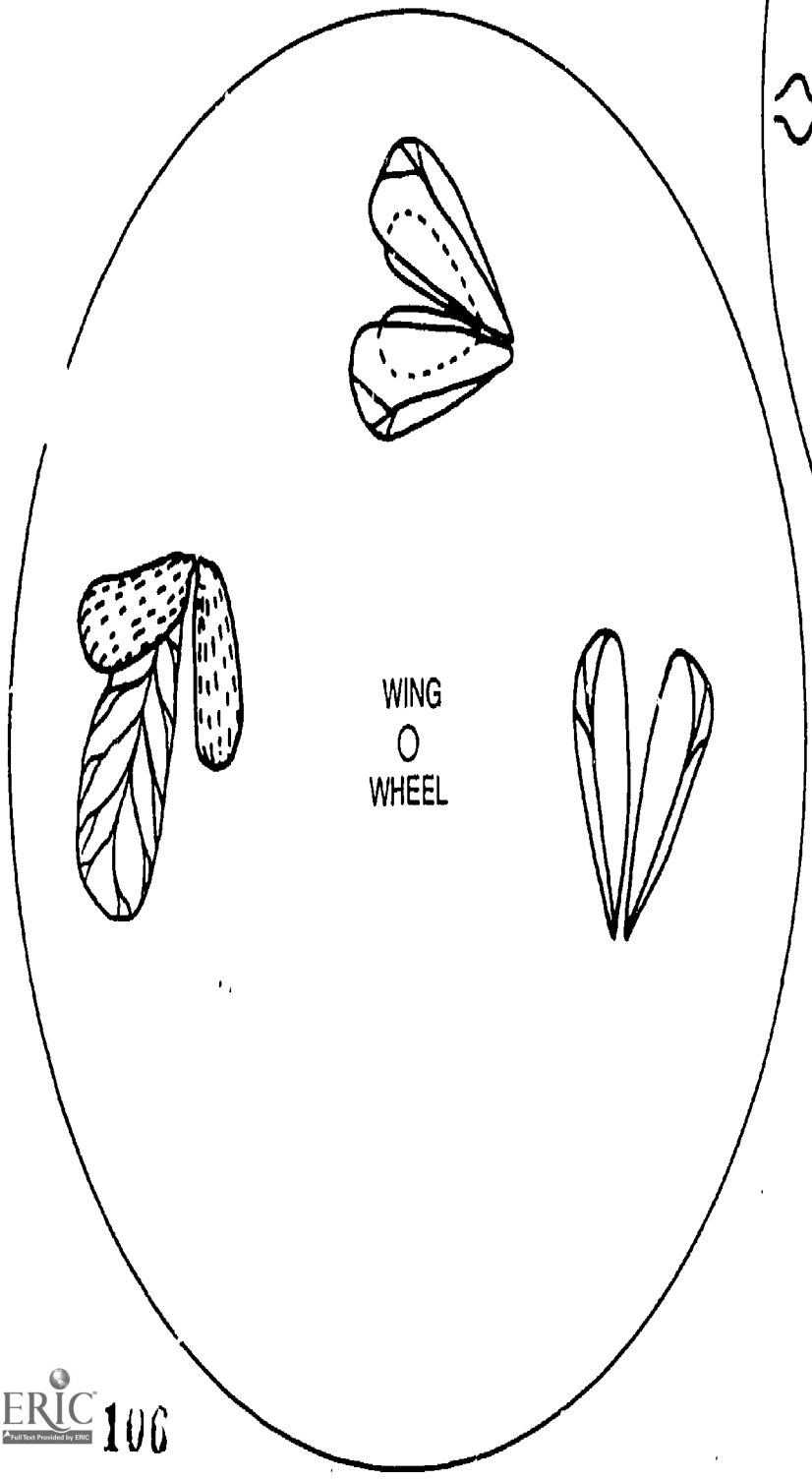
1. Turn all four wheels so the window shows no body parts.
2. Locate an animal from the litter.
3. Look at it closely.
4. Select a head (the front part) that most closely resembles the head of your critter by turning the head wheel.
5. Next select a thorax, the middle part of the animal.
   How many legs does it have?
6. Then choose an abdomen, the last part.
7. Finally, does your animal have wings?

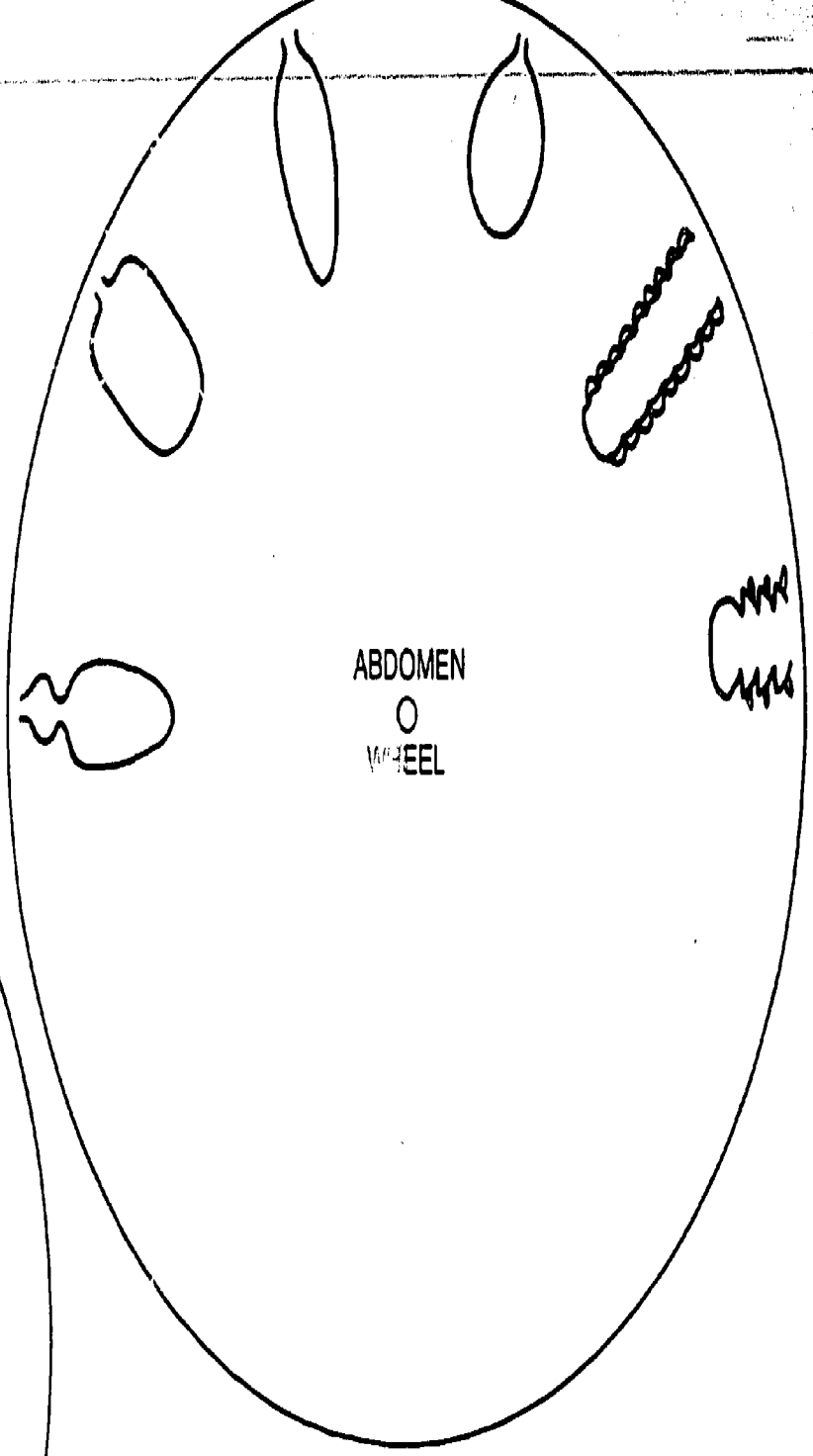
How to make a record of your critter:

1. Cut out the appropriate body parts from the "Body-Parts Sheet" and tape them to a Record Card.
   Or . . . trace your critter on a Record Card.
2. Color your picture to make it more closely resemble the animal you caught.

THERMOFAX MASTER, CARD 2
ABDOMEN AND WING WHEELS

Directions: Duplicate these wheels onto an overhead transparency using a thermofax machine or any similar infrared, thermal transparency maker or copy machine. A set of four thermofax transparency wheels is available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.





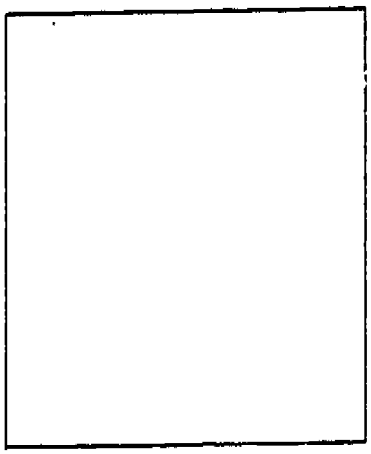
Litter Critter Wheel RECORD CARD

Outdoor Biology Instructional Strategies

Team _____ Activity Site _____

Date _____

Reconstruct your organism here:



HEAD THORAX ABDOMEN

Size:

(Draw a line as long as the organism.)

- Are there any special color patterns on your organism?
- Draw on any special features you think are important. Color your picture to make it more closely resemble the captured organism.

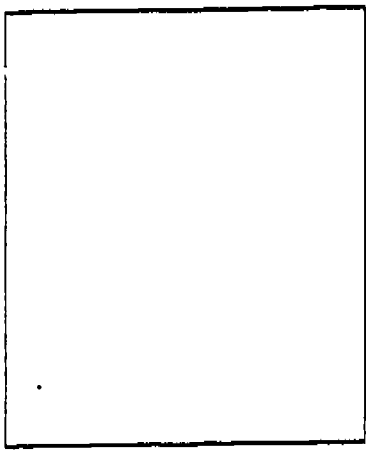
Litter Critter Wheel RECORD CARD

Outdoor Biology Instructional Strategies

Team _____ Activity Site _____

Date _____

Reconstruct your organism here:



HEAD THORAX ABDOMEN

Size:

(Draw a line as long as the organism.)

- Are there any special color patterns on your organism?
- Draw on any special features you think are important.
- Color your picture to make it more closely resemble the captured organism.

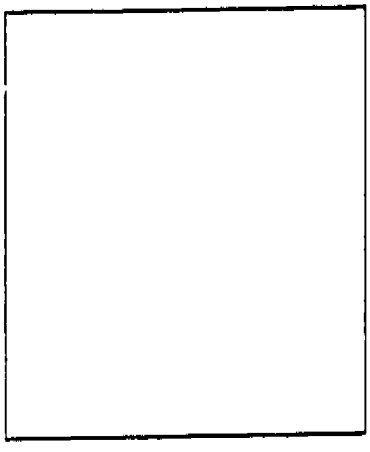
.itter Critter Wheel RECORD CARD

Outdoor Biology Instructional Strategies

Team _____ Activity Site _____

Date _____

Reconstruct your organism here:



HEAD THORAX ABDOMEN

Size: 108

(Draw a line as long as the organism.)

- Are there any special color patterns on your organism?
- Draw on any special features you think are important.

your picture to make it more closely resemble the captured organism.

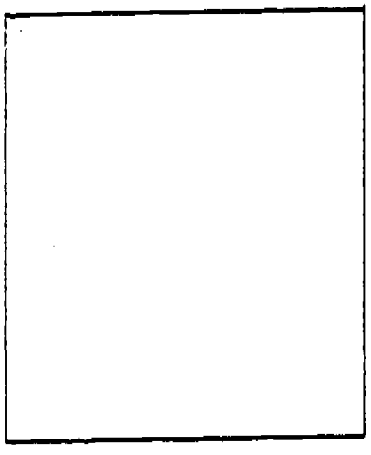
Litter Critter Wheel RECORD CARD

Outdoor Biology Instructional Strategies

Team _____ Activity Site _____

Date _____

Reconstruct your organism here:



HEAD THORAX ABDOMEN

Size:

(Draw a line as long as the organism.)

109

- Are there any special color patterns on your organism?
- Draw on any special features you think are important.
- Color your picture to make it more closely resemble the captured organism.

WHAT DO YOU THINK?

☐ How many kinds of animals did the group find?
☐ Which animals had all three body parts?
☐ Which animals had wings?
☐ Which areas of the litter contained the most animals? How are the animals found in the moist litter different from those in the dry parts?
☐ What were some difficulties you had in recording some organisms?
☐ What generalizations could you make about the color, size, and movements of litter critters?

FOLLOW THROUGH

1. Investigate organisms associated with man-made litter. Compare animals found around cans, bottles, paper, etc., to the animals you found in natural litter.
2. Do the same activity in different litter habitats. How does the number of different kinds of animals (diversity) or the population size of one kind of animal (abundance) compare at the different sites?
3. Do the same activity at the same site at different times of the year: under snow, after rain, during rain. If animals are not present at these times, where do you think they went? If animals are present, how do they compare with those originally found?

WHAT TO DO NEXT

	Set
Animal Diversity	II
Old White Sheet Trick	II
Animals in a Grassland	I
Sticklers	I

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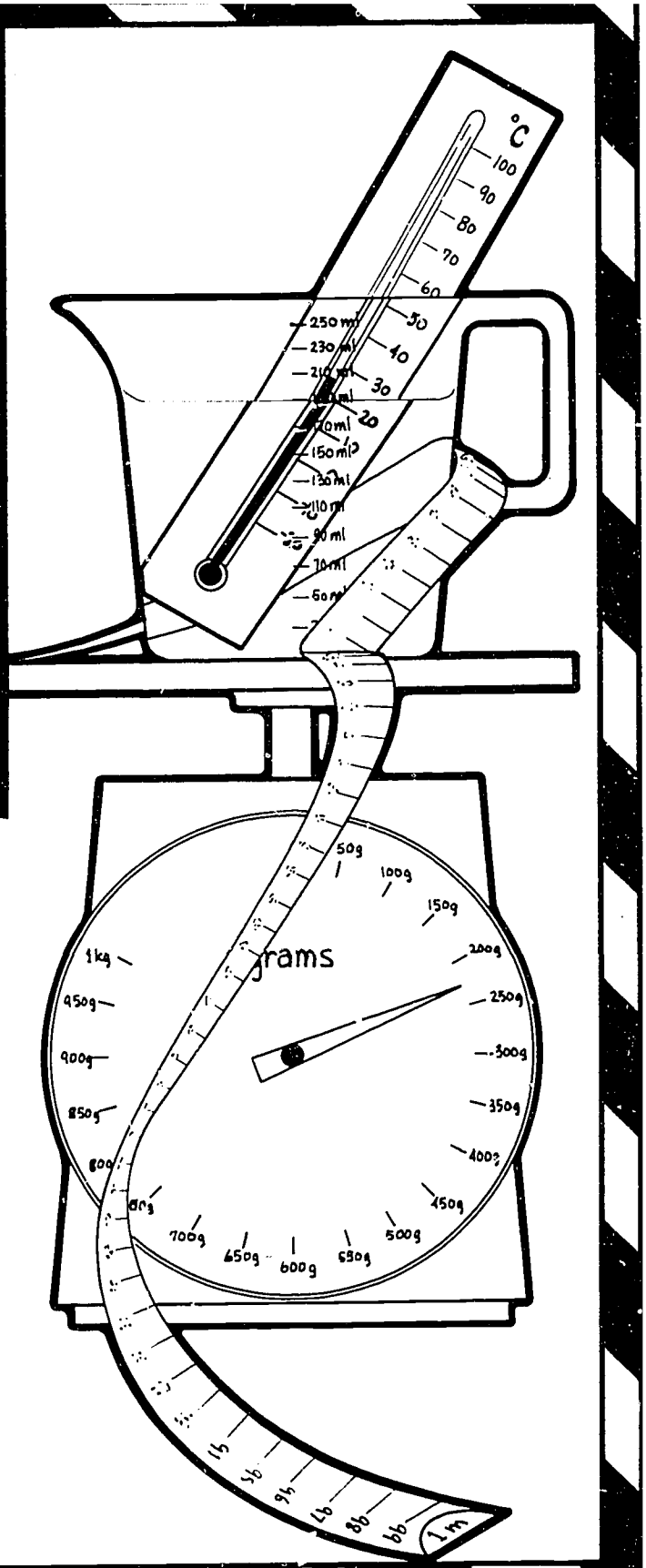
You may have heard the old saying, "Give 'em a centimeter and they'll take a kilometer." Give your youngsters centimeters, kilometers, liters, grams, and degrees celsius, and they will take home a new system of weights and measures. The **metric system** is the household system of measure in most countries outside the U.S. Soon the metric system will be in common use in the U.S. and you will be ready. Measurements in all OBIS activities are conducted in metrics, so you might want to go on a metric caper before embarking on other investigations. The basic metric system is pictured here.



LEARN ABOUT THE METRIC SYSTEM BY MEASURING FAMILIAR OBJECTS IN YOUR ENVIRONMENT.

WEIGHT
Basic unit is the gram (g)
1000 milligrams (mg) = 1 gram
1000 grams = 1 kilogram (kg)
1000 kilograms = 1 metric ton

LENGTH
Basic unit is the meter (m)
1000 millimeters (mm) = 1 meter
100 centimeters (cm) = 1 meter
1000 meters = 1 kilometer (km)

VOLUME
Basic unit is the liter (l)
1000 milliliters (ml) = 1 liter

TEMPERATURE
Basic unit is the degree Celsius (°C)
0°C = ice
100°C = boiling water

Explain that each team is going into the other team's territory to estimate, without using measuring tools, the values for the items the other team measured. Have each team try to determine the opposition's mystery number. You might wish to subdivide the teams into buddy teams to encourage everyone to make guestimates. Which team comes closest?

AFTER THE CAPER

☐ Hold up several cans and bottles from the supermarket and have the kids estimate the volume and/or weight of the contents. Open a can of peas and find the weight of the peas and the weight of the liquid.

☐ Make a metric collage. In your activity area, find objects that are exactly 1 gram, 1 kilogram, 1 liter in volume, 1 meter, etc.

☐ How fast can you run? Use a watch to find out how many meters you can run in one minute.

☐ How fast do bugs walk? How fast do butterflies fly?

WHAT TO DO NEXT

	Set
Beach Zonation	II
Bean Bugs	I
Terrestrial Hi-Lo Hunt	I

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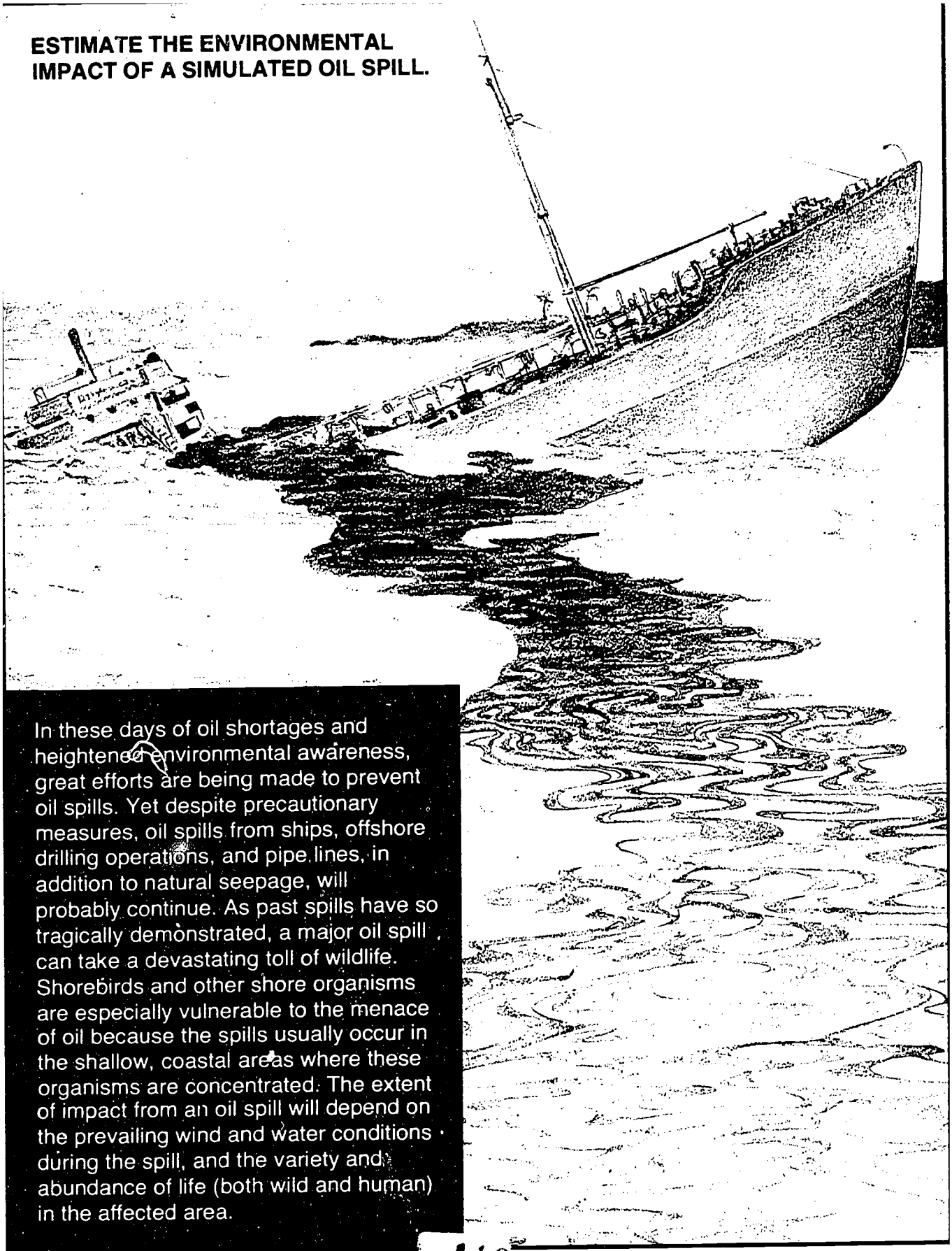
ESTIMATE THE ENVIRONMENTAL IMPACT OF A SIMULATED OIL SPILL.



In these days of oil shortages and heightened environmental awareness, great efforts are being made to prevent oil spills. Yet despite precautionary measures, oil spills from ships, offshore drilling operations, and pipe lines, in addition to natural seepage, will probably continue. As past spills have so tragically demonstrated, a major oil spill can take a devastating toll of wildlife. Shorebirds and other shore organisms are especially vulnerable to the menace of oil because the spills usually occur in the shallow, coastal areas where these organisms are concentrated. The extent of impact from an oil spill will depend on the prevailing wind and water conditions during the spill, and the variety and abundance of life (both wild and human) in the affected area.

OBIS OIL SPILL
Impact Challenge Card #1

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Landscape. Follow the spill and estimate its impact on the landscape. Use a 25-meter length of twine to measure the area the spill covered.

Estimates: Water____sq. meters (length times width)
Land____sq. meters (length times width)

Where did most of the popcorn end up? Why? How might the underwater landscape be affected? How did the spill change the general appearance of the landscape?

OBIS OIL SPILL
Impact Challenge Card #2

Outdoor Biology
Instructional Strategies

Plant Life. Follow the spill and estimate its impact on plant life.
How many different types of plants were affected?
Which plants were hardest hit by the spill? Why?
How might an oil spill affect land plants?
How would animals that eat aquatic plants be affected?

OBIS OIL SPILL
Impact Challenge Card #3

Outdoor Biology
Instructional Strategies

Animal Life. Follow the spill and estimate the impact of the spill on the animal life.
How many different types of animals were covered with oil?
Which animals were hardest hit by the spill? Why?
Which animals do you think would be capable of escaping from a spill? Which animals might not be able to escape?
How might an oil spill affect animals that live under rocks in the water?

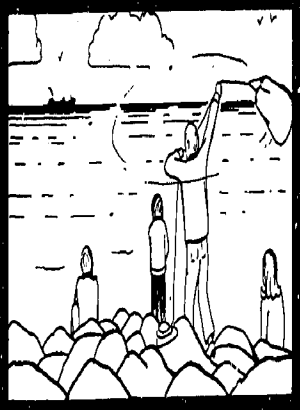
OBIS OIL SPILL
Impact Challenge Card #4

Outdoor Biology
Instructional Strategies

Human Activities. Follow the spill and estimate its impact on human activities.
How might an oil spill affect fishing and other recreation activities such as swimming, water skiing, surfing, diving, etc?
How might boats, docks, breakwaters, and other water structures be affected?
How might drinking water or food be affected by an oil spill?

ACTION

1. At the activity site, quickly outline the activity. Explain to your group of environmental impact experts that they are responsible for estimating the impact of the spill on (a) the landscape, (b) the plant life, (c) the animal life, and (d) human activities. Divide the group into buddy teams and assign one to two teams to each of the above areas by handing out Impact Challenge Cards. Remind the teams to work on the assumption that anything the popcorn touches will be covered with oil.
2. Before you toss out the popcorn, ask the teams to predict in which direction the spill will move and how long it will take to reach the shore. Select a buddy team with a wristwatch to measure the time it takes for the spill to reach the shore or other reference point.
3. Toss out the popcorn and let your environmental experts begin their impact investigations.



4. Join in and follow the movement of the spill with the rest of the group.

SLICK TALK

Near the end of the alloted time or after the spill has been thoroughly dispersed, gather the teams together to report their impact findings on (a) the landscape, (b) the plant life, (c) the animal life, and (d) human activities.

Some impact questions to consider:

How quickly did the spill reach the shore?

What agents dispersed the spill? (Wind, tide, etc.)

How might different wind or water conditions affect the spill?

How could an oil spill be prevented from spreading?

Who should be responsible for cleaning up the spill?

OBIS OIL SPILL

FOLLOW THROUGH

Try creating another "oil spill" under different conditions (outgoing versus incoming tide, windy versus calm day) or in a different site (river versus lake, ocean versus lake, one side of a breakwater versus the other side, etc.). Compare the effects of the second spill with those of the first.

Try different methods of containing an oil spill.

FURTHER INVESTIGATIONS

	Set
Water Breathers	*II*
Trail Impact Module	*Module*
Too Many Mosquitoes	*II*
Great Streamboat Race	*I*

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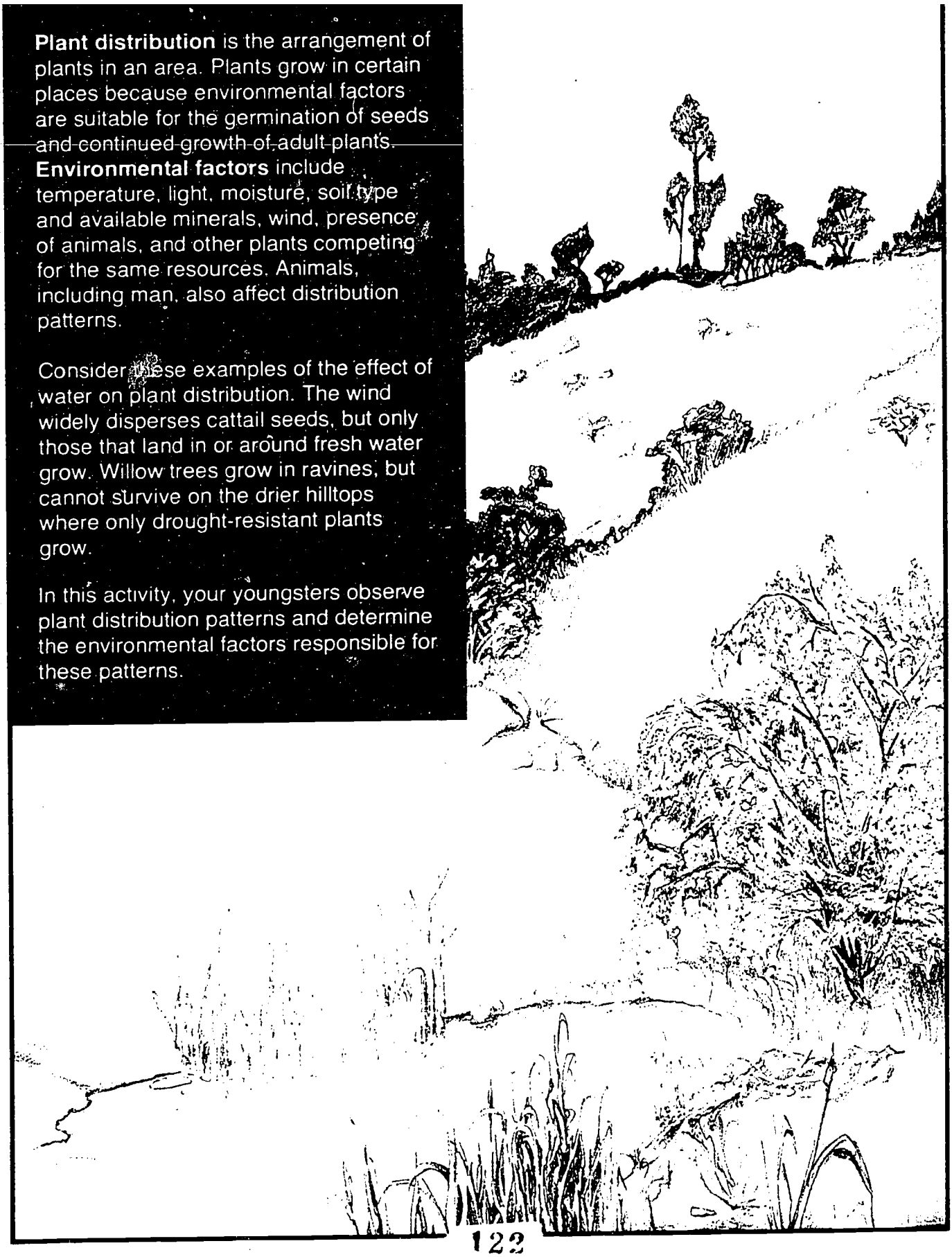
Plant distribution is the arrangement of plants in an area. Plants grow in certain places because environmental factors are suitable for the germination of seeds and continued growth of adult plants. **Environmental factors** include temperature, light, moisture, soil type and available minerals, wind, presence of animals, and other plants competing for the same resources. Animals, including man, also affect distribution patterns.

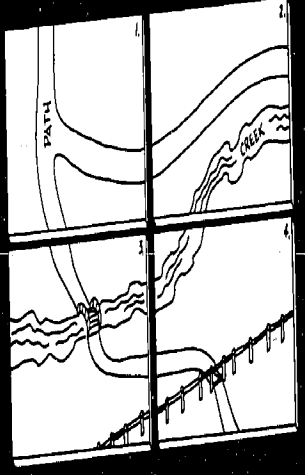
Consider these examples of the effect of water on plant distribution. The wind widely disperses cattail seeds, but only those that land in or around fresh water grow. Willow trees grow in ravines, but cannot survive on the drier hilltops where only drought-resistant plants grow.

In this activity, your youngsters observe plant distribution patterns and determine the environmental factors responsible for these patterns.



PLANT PATTERNS

LOCATE AND MAP THE EIGHT MOST IMPORTANT PLANTS IN YOUR TEAM'S SECTION OF THE STUDY SITE.

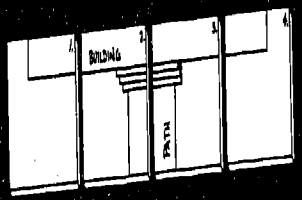


PREPARATION

In choosing your study site, keep in mind that an unmanaged area (vacant lot or field) shows the influence of natural environmental factors on plant distribution. A managed area (garden or park), however, illustrates man's influence. The best study site is one containing both types of areas where teams could compare different plant patterns.

Each team of two to four should work in an area 8-10 meters square. To avoid confusion, mark the corners of each of the sections in the study area with ribbon or flagging.

You can prepare the basic overview map ahead of time or with the group. Draw an overview map of the physical structures of the entire study site



including streams, roads, sidewalks, and buildings. Do not include plants. If there are four teams, the map should cover four data boards. With large groups, divide the area into more sections rather than putting more members on each.

MATERIALS

For each team of two to four:

1 data-board map section
1 felt pen
2-4 paper collection cups or bags
- bag containing 8 different colors of self-adhesive labels, 40 labels of each color (or squares or dots of contact paper, crayons, or colored construction paper and glue). A good size range for the labels is 1.5 to 3 cm.

For the group:

- ribbon or flagging
1 data board
1 roll of transparent tape

See the *OBIS Toolbox* folio for instructions on making a data board.

ACTION

1. Construction of the leaf identification key.

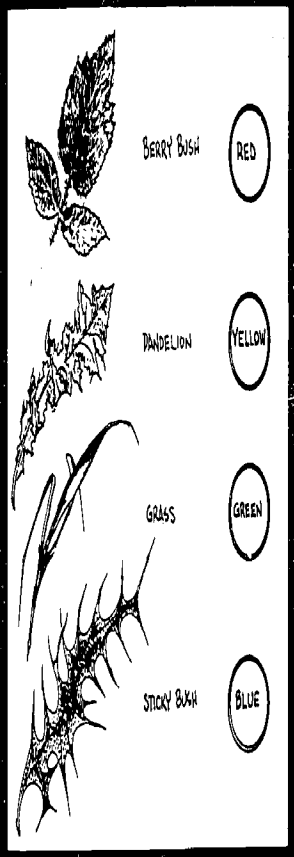
a. Set the limits of the study site. Review the conservation ethic with regard to taking leaf samples. (See the *Leader's Survival Kit* folio.) If necessary, obtain permission to take leaf samples from the site. If you cannot collect a leaf sample from a particular plant, a sketch of the leaf is a good substitute. (Avoid poison oak, ivy, or sumac, and point them out to the group ahead of time.)

poison oak poison ivy poison sumac

b. Have each youngster collect a leaf or representative sample from the five most important plants in the entire area. Let each child decide which plants are "important." You may wish to offer a few suggestions as to what makes a plant important: its size, its economic significance, its beauty, its aroma, etc.

c. Have the youngsters place leaves of the same type in one container. You might ask the participants how they decided which plants were important. The eight plants selected most often by the group will be named the most important plants. Construct a leaf identification key by taping these plant samples to the group data board.

Represent each type of plant with a label of a different color and/or shape. Allow the students to choose the labels for the plants and place them on the data board.



Example of leaf identification key

2. Display the overview map of the study site and orient the group.
3. Separate the map into its original sections and divide the group into teams of two to four.
4. Introduce the challenge: Using the colored labels which represent different plants, LOCATE AND MAP THE LOCATION OF THESE PLANTS IN YOUR SECTION OF THE STUDY SITE.
5. Describe the action:

a. Each team duplicates the leaf identification key, using leaf samples, on its own section of the map.
b. The teams take their data boards and labels and survey their study areas. Each time someone finds one of the eight plants, he or she should place

the corresponding colored label at the appropriate location on the map.

6. When everyone is finished surveying and mapping, put the sections of the map together and gather for a group discussion. Each team should briefly describe the plant patterns revealed on its section of the map.

WHAT DO YOU THINK?

1. What is the most common color on the overview map and which plant does it represent? The most abundant plants in an area are called **dominants.** Dominant plants cover more space or are larger than others and usually have a controlling influence on other organisms in the area. What are the dominant plants in your study area?
2. Do certain colors appear next to each other several times on the map? Why might this be?
3. Introduce the meaning of **plant distribution:** the arrangement of plants in an area. Which **environmental factors** (light, wind, rain, soil) might be affecting the distribution of the plants we found?
4. Animals, including man, are also considered environmental factors. What effect do animals and man have on the distribution of plants in your area?

FOLLOW THROUGH

Use your map to indicate where animal activity occurs in the study area by marking trails, feces deposits, fur or feather snags, etc., on the map.

WHAT TO DO NEXT

	Set
Lichen Looking	II
Sensory Hi-Lo Hunt	II
Terrestrial Hi-Lo Hunt	I
Plants Around a Building	I

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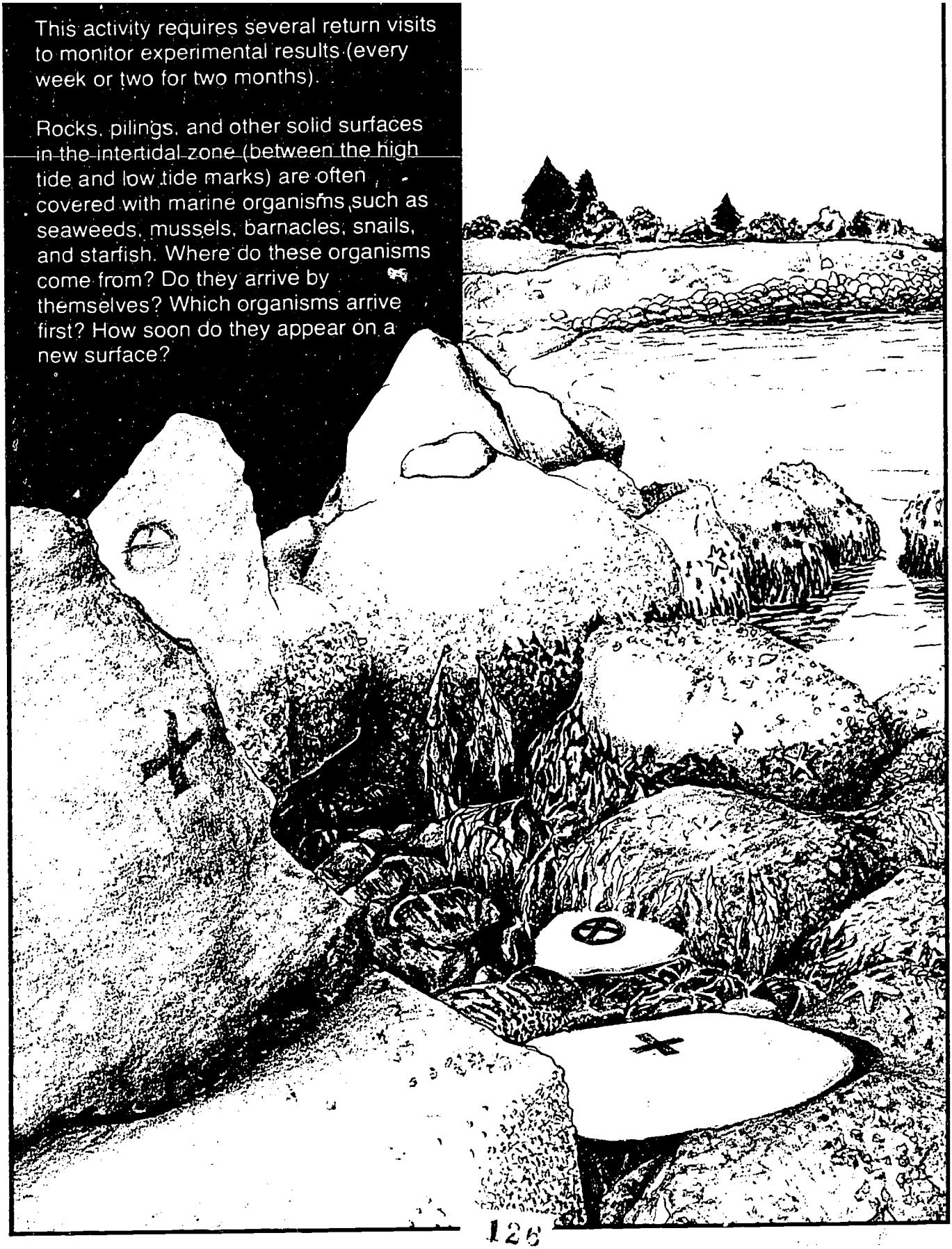
This activity requires several return visits to monitor experimental results (every week or two for two months).

Rocks, pilings, and other solid surfaces in the intertidal zone (between the high tide and low tide marks) are often covered with marine organisms such as seaweeds, mussels, barnacles, snails, and starfish. Where do these organisms come from? Do they arrive by themselves? Which organisms arrive first? How soon do they appear on a new surface?



PLACE A BARE ROCK IN THE INTERTIDAL ZONE AND WATCH TO SEE WHICH ORGANISMS COLONIZE IT AND WHEN THEY ARRIVE.

This activity investigates the process of **colonization**: the establishment of a population of organisms in an area where that organism did not appear before. You can observe this process by introducing new surfaces (Pioneer Rocks) into the intertidal zone, and monitoring the developments on these surfaces. If you observe your Pioneer Rocks for a long enough period of time, you may see some of the pioneer organisms replaced by other populations. **Succession** is the replacement of one population with another. This process will continue until the plants and animals on your Pioneer Rocks look just like those on the surrounding rocks.

MATERIALS

For each team of two:

1 marking pen (permanent ink, bright colors)

For the group:

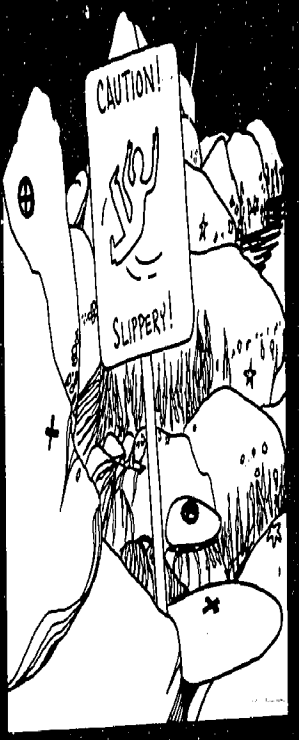
1 data board

1

PREPARATION

Choose a site with rocks that are accessible to the kids. You should be aware of the tidal situations for your planned activity times. If you happened to meet during a high tide, your experiments would be covered by water and out of reach. You can obtain a tide table from bait shops and sporting goods stores. (See "Use of the Tide Table" Equipment Card in the *OBIS Toolbox* folio.) The first activity will take one period, but follow-up observations may take only ten to fifteen minutes. Plan other activities for those days. (See SUBSEQUENT MEETINGS section.)

Caution! Rocks in the intertidal zone are notoriously slippery. Caution your youngsters to use care moving over them and in placing the new rocks in the intertidal zone; fingers and toes caught between rocks can ruin the activity. Use the buddy system: no one should work alone during a seaside activity.



ACTION

1. **The Intertidal Zone.** Caution the youngsters about the slippery rocks and then take the group into the intertidal zone. Explain that this zone is the area between the high and low tide marks.

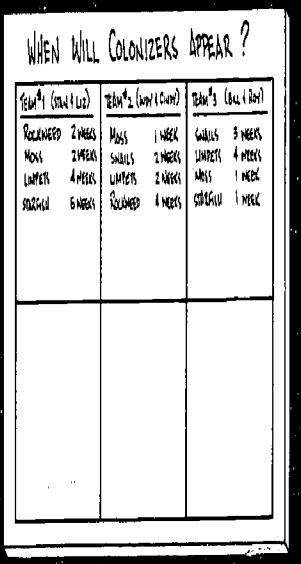
2. **Observing Life on the Rocks.** Point out a rock that seems to be a popular place for a number of different plants and animals to live. Ask the participants how they think the organisms got there. Allow time for your group to observe and comment. Does someone plant the organisms? Do they arrive by themselves? How can we find out? If the kids don't suggest putting something into the water to check colonization, suggest it yourself.

3. **Introducing New Real Estate.** Divide the group into buddy teams and ask each team to select a rock or other substrate to place in the intertidal zone. (See the VARIATIONS section.) Large rocks are best. However, if anyone is struggling with a rock that is obviously too large, step in and suggest something more reasonable. Be sure there is *no life* on these rocks. Distribute the marking pens and urge each team to mark its rock and a place on the shore near it so the rock can be found later. The "permanent" marks last only two to three weeks in the ocean environment, so you may have to re-mark your rocks.

4. **Introducing Colonization.** Define colonization and suggest that each rock being introduced into the study area is an unpopulated territory and the organisms that settle there are colonists. Names for the rocks (Pioneer Rock, Wanderer's Roost) are fun and should be encouraged.

RETURN VISITS

Now the real fun begins: finding out what happens! It may take several weeks for visible colonists to appear on your rocks. (Do the rocks feel or smell different before you see any changes?) When visible colonists do arrive, you should record their names and the date they were first observed. If you don't know the names of the organisms, make up some descriptive names (thread weed, polka dot snails).



THINKING ABOUT YOUR PIONEERS

Are rocks that are placed at different levels in the intertidal zone colonized at different rates?

Did the same organisms colonize all of the Pioneer Rocks?

Did the amount of exposure to air influence either the numbers or kinds of organisms colonizing your rocks?

Are the organisms on your Pioneer Rocks the same as those on the surrounding rocks? Are there any differences?

ROCK PIONEERS

VARIATIONS

To add some variety to this activity, you may wish to substitute wood, steel, plastic, or rubber for rocks. These substrates usually find their way into the sea through natural processes or man's neglect. You can find most of these substrates at or near your study site. Small and/or lightweight objects may have to be tied and anchored with twine to prevent tides from carrying them off.

FURTHER INVESTIGATIONS

1. Can you find substrates other than your pioneer rocks displaying various stages of colonization and succession?
2. How does man combat colonization of organisms on boats?
3. Where do you *not* find organisms colonizing a substrate? Can you figure out why?

SUBSEQUENT MEETINGS

	Set
Beach Zonation	II
OBIS Oil Spill	II
Hopper Circus	II

WHAT TO DO NEXT

	Set
Water Holes to Mini-Ponds	I
Out of Control	I

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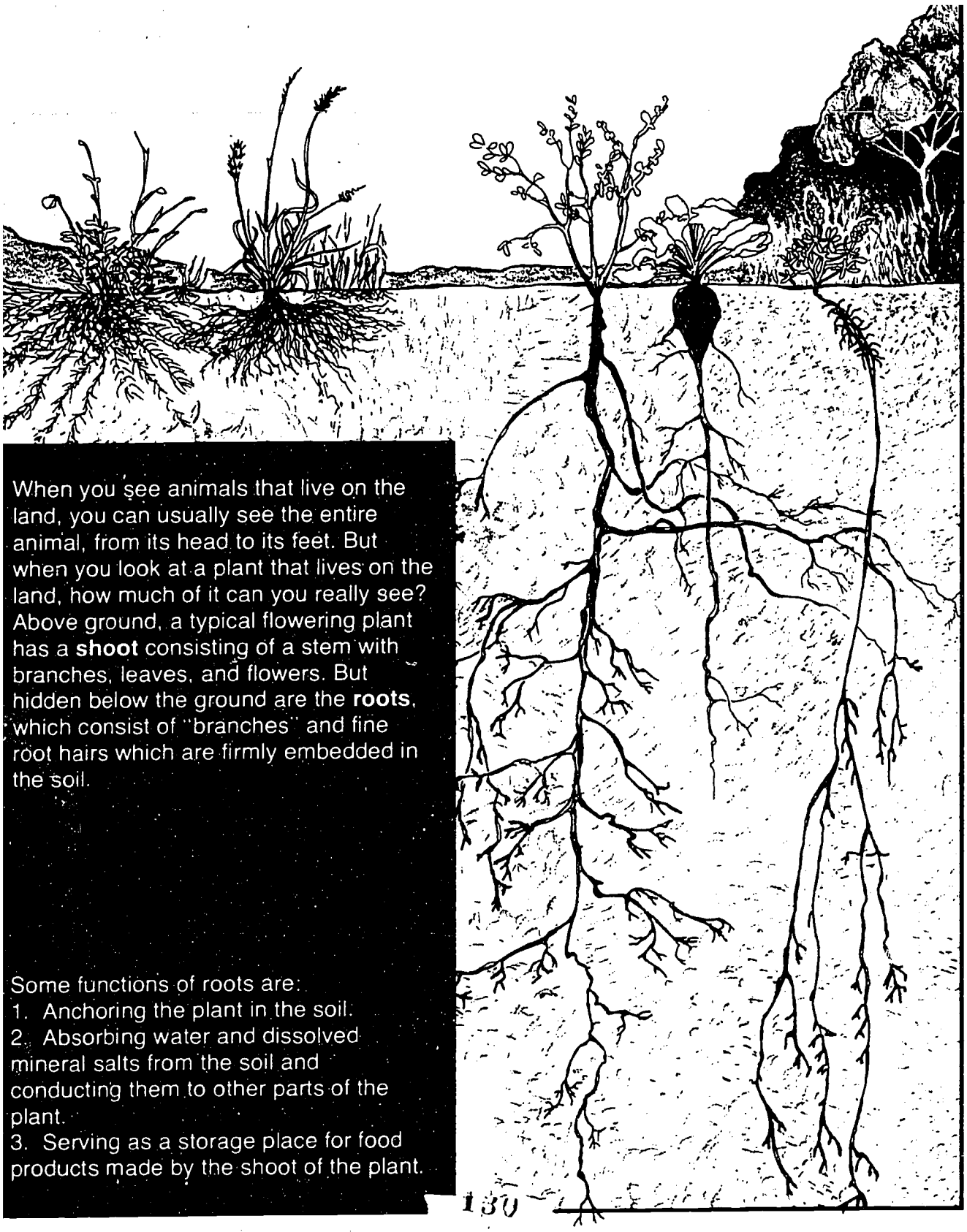


When you see animals that live on the land, you can usually see the entire animal, from its head to its feet. But when you look at a plant that lives on the land, how much of it can you really see? Above ground, a typical flowering plant has a **shoot** consisting of a stem with branches, leaves, and flowers. But hidden below the ground are the **roots**, which consist of "branches" and fine root hairs which are firmly embedded in the soil.

Some functions of roots are:
1. Anchoring the plant in the soil.
2. Absorbing water and dissolved mineral salts from the soil and conducting them to other parts of the plant.
3. Serving as a storage place for food products made by the shoot of the plant.

Different types of plants have different patterns of root growth. Grasses, including cereals such as wheat, oats, corn, and rice, usually have slender, fiber-like roots with no one root more prominent than others. This type of root structure is a **fibrous root** system. Other plants, such as the dandelion (a weed) or food crops such as carrots, beets, and radishes, have one large main root, called a **tap root.** A tap root plant can store large amounts of food in this large root. Roots also inhibit soil erosion caused by wind and water.

The same type of plant growing under different **environmental conditions** (such as different soil texture or amount of moisture in the soil) often shows variation in its root system. For example, a plant growing at the edge of a pond may have a shorter root system than the same plant growing in drier soil. Near the pond, water is available much closer to the soil surface and the root has little stimulus to grow further.

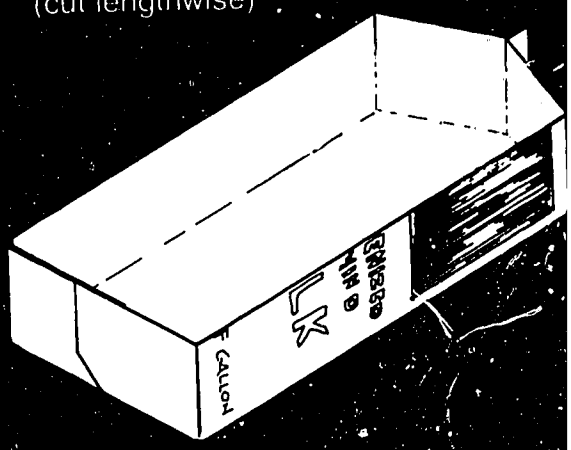
FIND PLANTS WITH ROOTS LIKE THOSE OF TWO MYSTERY PLANTS.

Roots and Shoots is a weed activity designed to motivate youngsters to investigate roots. Using the roots as their only clues, the teams seek to identify two mystery plants by digging and uncovering roots that match those of the mystery plants.

MATERIALS

For each team of two:

1 trowel
1 milk-carton half (cut lengthwise)



Optional:

1 hand lens

For the group:

2 large brown paper bags
- tape or string (to close the bags)

1 bucket of water
1 set of Action Cards

Available from the Lawrence Hall of Science. See the "Equipment Order Form" in the *OBIS Toolbox* folio.

PREPARATION

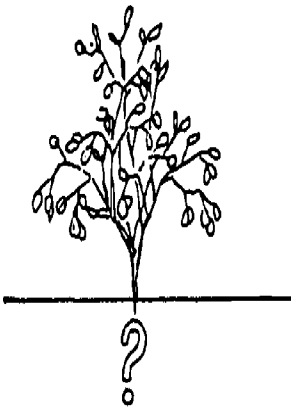
The best site for this activity is a weed lot, lawn, garden, or an old field. Be su to obtain permission, if necessary, to d up the weeds in your study site.

ROOTS AND SHOOTS
Action Card #1

Outdoor Biology Instructional Strategies

FIND:

a plant with a new type of root system, one that has not been found.



ROOTS AND SHOOTS
Action Card #2

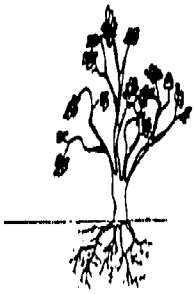
Outdoor Biology Instructional Strategies

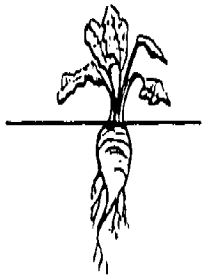
FIND:

a plant with a thicker main shoot than main root,

and

a plant with a thicker main root than main shoot.





ROOTS AND SHOOTS
Action Card #3

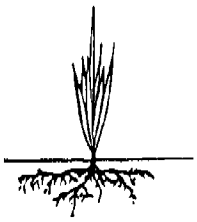
Outdoor Biology Instructional Strategies

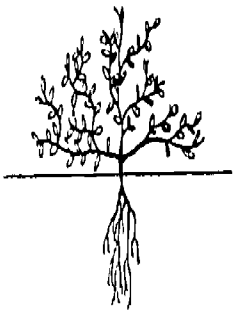
FIND:

a plant with a wider root system than shoot system,

and

a plant with a wider shoot system than root system.





ROOTS AND SHOOTS
Action Card #4

Outdoor Biology Instructional Strategies

FIND:

a plant with longer roots than shoot,

and

a plant with a longer shoot than roots.

ROOTS AND SHOOTS
Action Card #5

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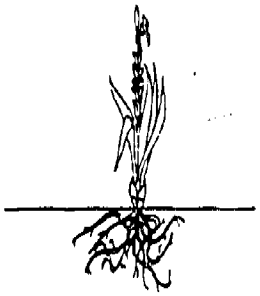
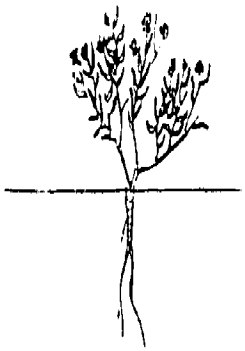
Instructional Strategies

FIND:

a plant with more root branches than shoot branches, and a plant with more shoot branches than root branches.





ROOTS AND SHOOTS
Action Card

Outdoor Biology
Instructional Strategies

ROOTS AND SHOOTS
Action Card

Outdoor Biology
Instructional Strategies

ROOTS AND SHOOTS
Action Card

Outdoor Biology
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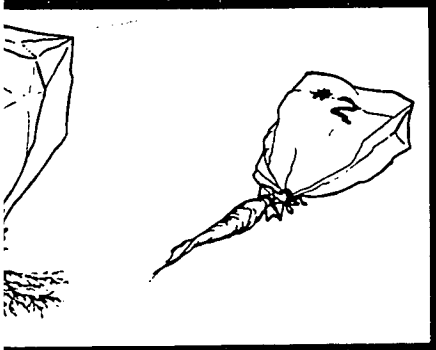
TS AND SHOOTS

t plant will be Mystery Plant
-root plant. Mystery Plant #2



N

to the youngsters that they
gate the weeds in their study
ularly that part of the plant
see, the **roots**. Tell them that
ground part of the plant is the
ich consists of the stem,
leaves, and flowers.
ce Mystery Plant #1 to the
lain that the shoot is inside
nly the roots are exposed. Ask
for a descriptive name to use
rring to the plant's roots.
the limits of the study area
out the plants, if any, that
be disturbed. Divide the
teams of two. Challenge each
d several different plants with

encouraging the youngsters to take the time to get all the roots with the shoot. You might want to ask some questions as you visit the teams. Does the soil cling to some types of roots more than to others? Do your plant's roots look like the Mystery Plant's roots? If not, how do they differ? Do you think your plant is the same kind as the Mystery Plant? (Washing the roots in a bucket of water to remove soil makes closer examination possible.)

5. When all the youngsters have washed and compared their roots, have them form a root "lineup," grouping those plants with roots similar to Mystery Plant #1.
6. Introduce Mystery Plant #2. Ask the group for a descriptive name for these roots and challenge the teams to find plants with similar roots. Have the teams follow the same procedure of investigation they used with Mystery Plant #1, ending with another root lineup.
7. Ask the youngsters to guess the identity of the two Mystery Plants. Can the kids tell what the shoot looks like when they can only see the roots? Let the suspense build as they guess; then uncover the mystery shoots. Who was correct?
8. One final challenge. To each team, distribute one action card and milk-carton half. Have each team bring back the plants described on its card.
9. Optional. Have each team explain how its plants fit the challenge on the card. Point out some of the more unusual roots found. Provide hand lenses for observation.

GETTING TO THE ROOT OF THE MATTER

☐ How would you explain two plants of the same kind that have roots that are *not* the same?
☐ Why do you think there are so many variations in root systems?
☐ Did you find any animals near the roots of the plants? What do you think the animals were doing there?
☐ How do animals, including man, use plant roots? Have you ever eaten a root?
☐ What kind of root would you design for dry soil? Sandy soil? Wet soil? Hard soil? No soil?

DIGGING DEEPER

1. Make sunprints of the roots. This could be the start of another mystery game.
2. Explore the differences in root systems in a managed and an unmanaged area. (See *Out of Control*, Set I.)
3. Germinate some seeds on a moist paper towel. Which comes first, the root or tne shoot.

WHAT TO DO NEXT

	Set
Gaming in the Outdoors	II
Plant Patterns	II
Seed Dispersal	I
Invent a Plant (consider roots)	I

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chor. However, bits and pieces of
ganisms from more hospitable
virbnments often litter these beaches.
here do these remnants of organisms
me from and how do they reach your
tivity site? This activity invites your
rticipants to discover if the motions of
e sea could be responsible for
nsporting this organism debris.

**VESTIGATE THE MOTIONS
F THE SEA.**

PREPARATION

In this activity, the group uses simple devices to investigate oceanic motions along the beach. (You can easily adapt this activity to large lakes with debris-littered shores. Choose a day with good wave action to do the activity.) With the exception of the fishing equipment (which you can usually borrow) the suggested equipment is relatively inexpensive and easy to obtain. If you cannot acquire all the suggested materials, run the activity with the items you can obtain. The group can help you accumulate and set up the equipment. (See the "Seas in Motion" equipment cards in the *OBIS Toolbox* folio.) Setting up before you reach the seashore will allow you more investigating time on the beach.

MATERIALS

For the group:

4 meter sticks or tapes
4 waterproof marking pens
4 watches with second hands
• pencils*
2 tide tables (available from local fishing or diving shops)
• Action Cards (duplicated — 1 card per team)
• Equipment Cards (duplicated)

For special devices:

• balloons
• old tennis balls
• sand and tide stakes
• marked shells
• dye markers
• colored sand

Optional:

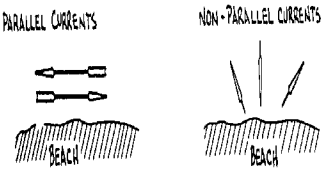
• fishing rods
• tossing cups

*See the "Seas in Motion" equipment cards in the *OBIS Toolbox* folio for instructions on construction or use and additional materials required.

SEAS IN MOTION Action Card #1

Outdoor Biology Instructional Strategies

Speed and Direction of Currents. Is there a current running parallel to the beach? Hand toss or use a fishing rod to cast tennis balls, water balloons,* or floating dye markers* into the surf. Use a watch and meter stick or tape to estimate their speed (meters per minute) and main direction of movement. Fling objects into several different surf spots and compare the estimated speed and direction of movement in different areas.



*See the "Water Balloons" and "Dye Markers" equipment cards in the *OBIS Toolbox* folio.

SEAS IN MOTION Action Card #2

Outdoor Biology Instructional Strategies

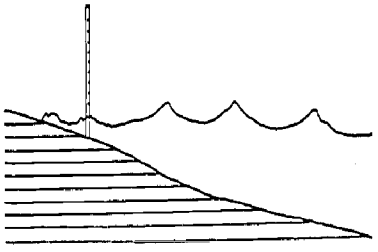
Movement of Floating Objects. Are floating objects tossed up on the beach or taken out to sea? Hand toss water balloons* (nearly full) or tennis balls into the surf and find out where they go.

*See the "Water Balloons" equipment card in the *OBIS Toolbox* folio.

SEAS IN MOTION Action Card #3

Outdoor Biology Instructional Strategies

Measuring Tidal Changes. Is the tide coming in or going out? Set up tide stakes* to measure both the vertical tidal change (height) and the horizontal tidal change (movement of the water lap line) during the activity period.

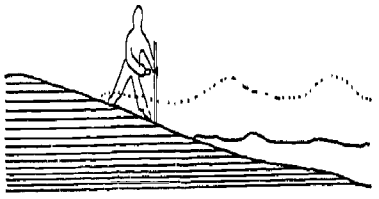


*See the "Tide Stakes" equipment card in the *OBIS Toolbox* folio.

SEAS IN MOTION Action Card #4

Outdoor Biology Instructional Strategies

Sand Movement. Is the water moving the sand on or off the beach? To find out, you can put sand stakes* in the area between the highest point the water reaches and the lowest point to which the water recedes on each wave. Currents can be dangerous so work your way out slowly and stop before the water level reaches the top of the 60-cm stake planted in the sand.

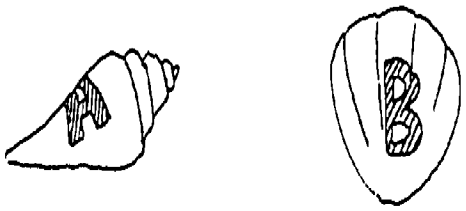


*See the "Sand Stakes" equipment card in the *OBIS Toolbox* folio.

SEAS IN MOTION
Action Card #5

Outdoor Biology Instructional Strategies

Shell Movement. What happens to shells when you toss them into the surf? How far up or down the beach do they move? Mark both sides of some shells with waterproof markers and use the screen-bottomed container* to toss the shells into the surf. See where they turn up.



*See the "Tossing Cup" and "Marked Shells" equipment cards in the *OBIS Toolbox* folio.

SEAS IN MOTION
Action Card #6

Outdoor Biology Instructional Strategies

Floaters and Non-Floaters. What happens to floating, sinking, and neutrally buoyant objects when you toss them into the water together? Use freshwater balloons* or tennis balls as floating objects, salt-water balloons* as neutrally buoyant objects, and bundles of shells as sinking objects. Hand toss the objects. Time their motions and measure the distances that they cover.

	DISTANCE	TIME
FLOATING		
NEUTRAL		
SINKING		

SEAS IN MOTION
Action Card #7

Outdoor Biology Instructional Strategies

Movement of Materials. What happens to bits and pieces of organisms when they are tossed into the water? Measure the distances covered and speed of travel.

ITEM	DISTANCE	TIME

SEAS IN MOTION
Action Card

Outdoor Biology Instructional Strategies

FOLLOW THROUGH

1. Go to the site the kids thought the organisms came from and conduct an organism hunt. Do results verify or refute their informed guesses?
2. Do this activity again on a different tide.
3. Return to the site during a minus tide to observe the shape and profile of the beach. Try to relate the shape of the beach to water movement off the beach.

WHAT TO DO NEXT

	Set
Beach Zonation	II
OBIS Oil Spill	II
Rock Pioneers	II
Seed Dispersal	I

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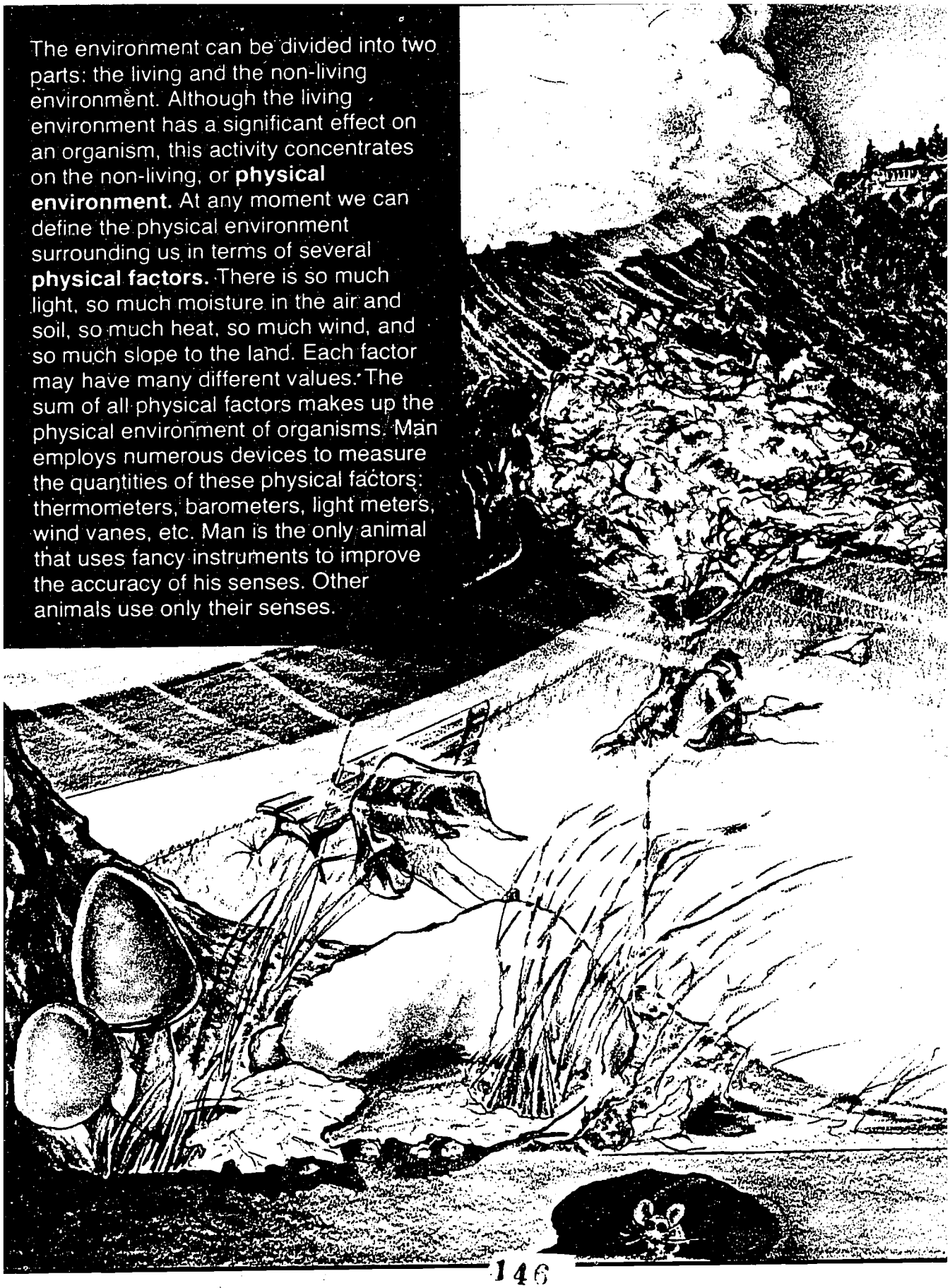
The environment can be divided into two parts: the living and the non-living environment. Although the living environment has a significant effect on an organism, this activity concentrates on the non-living, or **physical environment.** At any moment we can define the physical environment surrounding us in terms of several **physical factors.** There is so much light, so much moisture in the air and soil, so much heat, so much wind, and so much slope to the land. Each factor may have many different values. The sum of all physical factors makes up the physical environment of organisms. Man employs numerous devices to measure the quantities of these physical factors: thermometers, barometers, light meters, wind vanes, etc. Man is the only animal that uses fancy instruments to improve the accuracy of his senses. Other animals use only their senses.



USING ONLY YOUR SENSES, FIND THE HIGHEST AND LOWEST VALUES (EXTREMES) FOR SEVERAL PHYSICAL FACTORS IN YOUR STUDY SITE.

In this activity, you and your youngsters use *only your senses* to investigate your local environment and discover the physical factors you respond to most strongly. OBIS suggests two different techniques for organizing your Sensory Hi-Lo Hunt. (A) Use flags to mark the locations of highs and lows right in your study site. (B) Use an outline map of your study site to record highs and lows. After locating highs and lows, each youngster goes back into the site to respond "like an animal" to the environment. Finally, the group searches for animals and investigates the physical factors which affect the animals.

PREPARATION

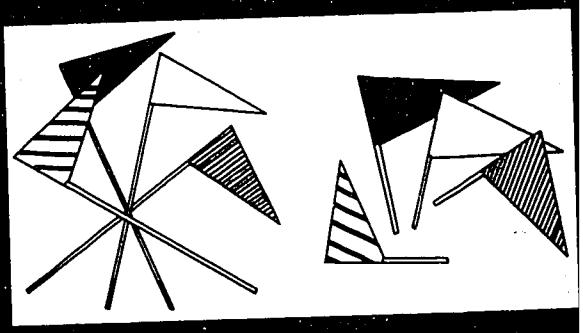
A good activity to precede this one is *Terrestrial Hi-Lo Hunt* (Set I).

The best site for a Sensory Hi-Lo Hunt is one with a diversity of vegetation and physical features. This is a good activity for a very hot, cold, windy, rainy, or snowy day, as opposed to a pleasant, calm day.

MATERIALS

Method A (Flags)

8 marker flags: 4 different colors, 1 tall and 1 short of each color



Method B (Map)

1 data board
4 felt-tip pens, 4 colors

WHAT DO YOU THINK?

☐ **Environmental Variables.** Ask the participants: "Will this spot (high temperature spot) be the warmest tonight? Next week at this time? Will this spot always be the windiest? Will the wind always be from the same direction?" Suggest that the physical factors in your environment may vary from minute to minute, day to day, or month to month, and are called **environmental variables.** In fact, as you have found, you have a variation of temperature, moisture, wind, etc., in your study site right now.

☐ **Habitat.** If the youngsters are not familiar with the term **habitat**, tell them it is the place where a plant or animal lives. Ask the youngsters how they think the animals select their habitats. Why does one plant appear in one habitat and not in another?

☐ Would you have chosen the same "spot" on a rainy day? Hot, sunny day? Windy day? At night? Why?

☐ How does man cope with hostile environments? Does he change the physical factors or modify his behavior? How do other animals adjust to extremes of environmental variables (hibernate, migrate, grow more fur, bathe in water)?

FOLLOW THROUGH

By conducting some simple experiments, test your ideas on the variables that evoke the strongest response from animals in your study site. Do the isopods under the log respond to light or moisture? How can you find out? Do ants respond to light or temperature? How can you find out?

WHAT TO DO NEXT

	Set
Plant Patterns	II
Rock Pioneers	II
Habitat Sun Prints	I
Sticklers	I

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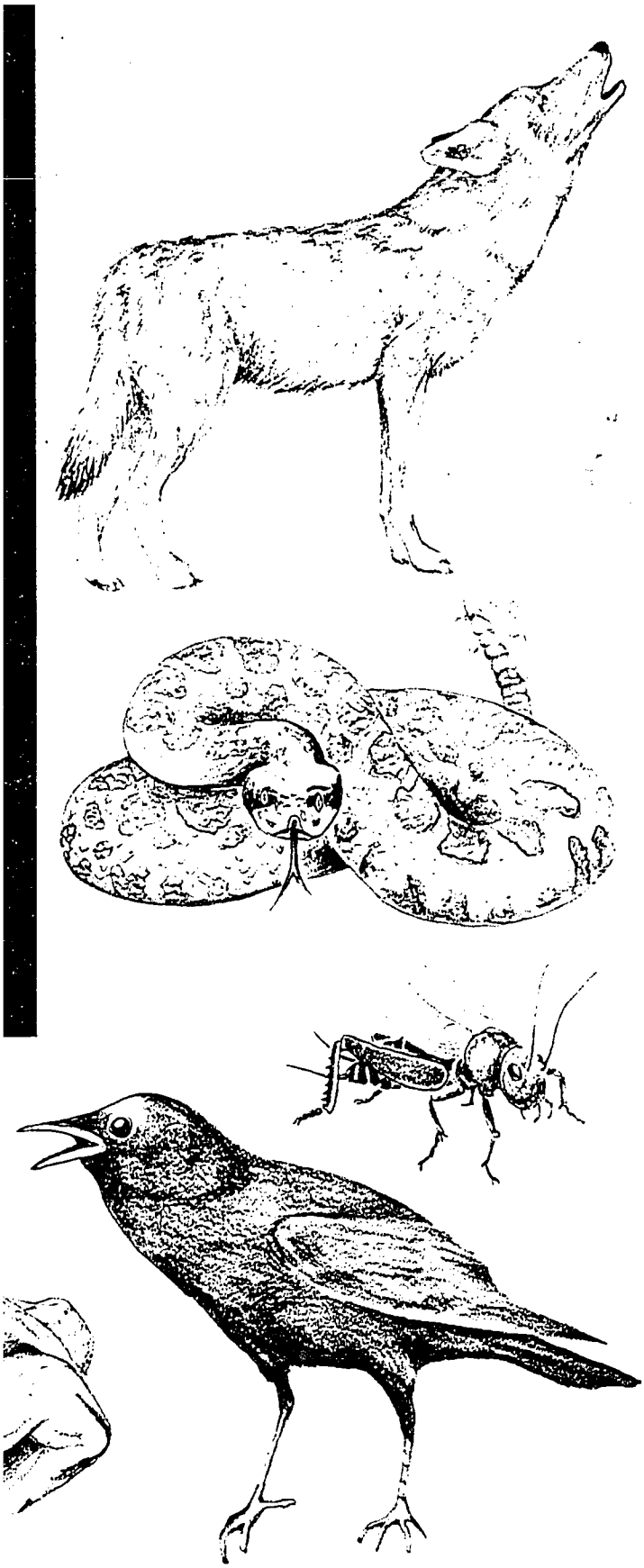
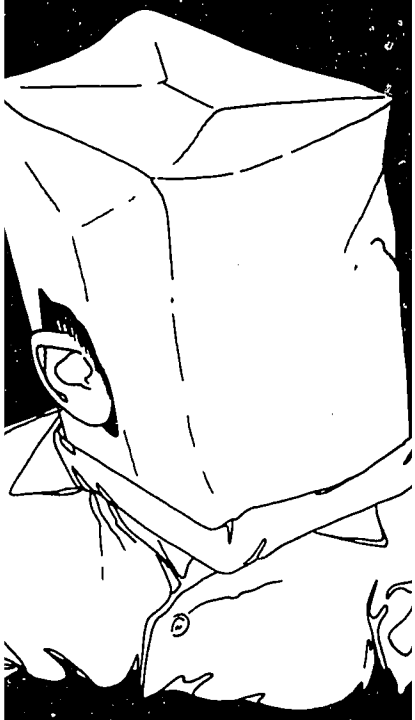


PARATION

nd Off requires a minimum o
pants and works even better v

e game is a good nighttime ac
se darkness limits the youngs
Dark nights with little moonli
st. If you play the game durin
nt hours, provide bags for ma
asks should allow the youngs
only straight down to their fe
o the bags to fit and cut out e



Choose an activity site with so
nes and trees, but no dangero
es or tricky obstacles. The ar
uld be large (approximately 4
m) and relatively equal in
ensions, i.e., not too narrow.
To make the noise-maker sele
to all players, tie a piece of st
cm long) to each noise make
dator sign (piece of paper ma
edator"). Start out with just on

d. Change the **distribution** of the predators and prey (the way they scatter over the area.)
e. Give one or two prey the ability to free other prey that are caught. This simulates reproduction for those prey that escape being eaten.
f. Change the time allowed for each game.

WHAT DO YOU THINK?

1. Which signals worked best in attracting and finding partners?
2. How did you successfully avoid a predator?
3. Besides attracting a partner, what else might animals be communicating to each other?

FOLLOW THROUGH

At twilight, or after dark, quietly listen for animal sounds and signals.

☐ Track down an animal sound.
☐ Try to determine if there are two or more animals communicating.
☐ Try to mimic a call or sound and see if you get a response.

WHAT TO DO NEXT

	Set
Birdfeeder	II
Old White Sheet Trick	II
Attention!	I

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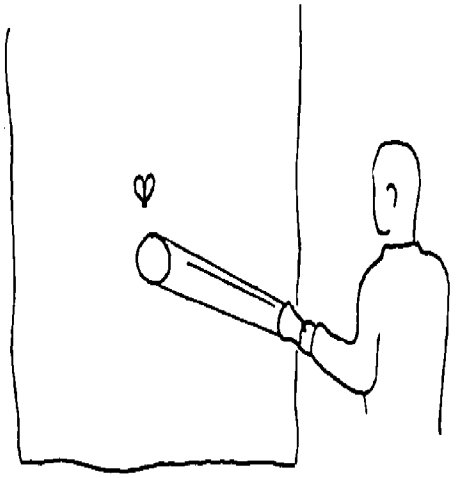
154

THE OLD WHITE SHEET TRICK
Action Card #1

Outdoor Biology Instructional Strategies

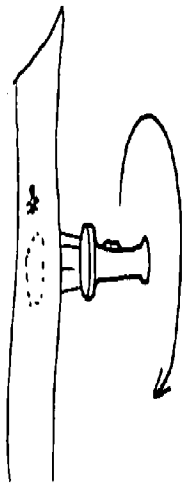
Use light to get one type of animal to move where you want it.



THE OLD WHITE SHEET TRICK
Action Card #2

Outdoor Biology Instructional Strategies

Shine the light through the sheet. How does moving the light around affect the animals? (Move the light slowly.)



THE OLD WHITE SHEET TRICK
Action Card #3

Outdoor Biology Instructional Strategies

Check the descriptions below that apply to animals that spend most of their time flying around.

___ Big	___ 6-legged
___ Small	___ 4-legged
___ Long	___ Big eyes
___ Short	___ Small eyes
___ Brightly colored	___ Big wings
___ Plain	___ Small wings

THE OLD WHITE SHEET TRICK
Action Card #4

Outdoor Biology Instructional Strategies

How do the animals act when they are:

a. in the brightest spot?
b. on the sheet, but away from the brightest spot?
c. captured and released one, two, and three meters away from the lighted sheet?

THE OLD WHITE SHEET TRICK
Action Card #5

Outdoor Biology Instructional Strategies

Place different colors of gel or cellophane over a flashlight and see which colors attract animals.

Color tried	Attracts	Doesn't Attract

THE OLD WHITE SHEET TRICK
Action Card #6

Outdoor Biology Instructional Strategies

Do smelly things such as vinegar, onions, sweaty socks, assorted human foods, perfume, etc., attract animals that come to light?

Smelly things	Made-up name of animal

THE OLD WHITE SHEET TRICK
Action Card #7

Outdoor Biology Instructional Strategies

Change the brightness of your light by masking it with paper or cloth. How does a change in brightness affect the light's ability to attract animals? If the lamp is hot, don't let the mask touch the bulb.

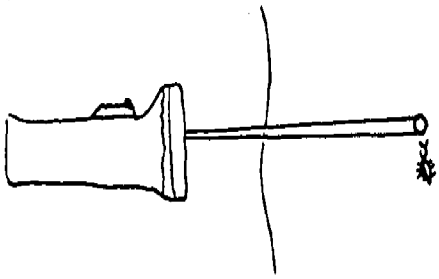
Bright _____
Less Bright _____
Dull _____
Very Dull _____
Off _____

THE OLD WHITE SHEET TRICK
Action Card #8

Outdoor Biology Instructional Strategies

Using aluminum foil, make a mask for your light. Poke a small hole in the foil so a small ray of light shines through. Move the ray of light across the sheet and see if you can get an animal to follow the light.

Try other sized holes.



THE OLD WHITE SHEET TRICK
Action Card #9

Outdoor Biology Instructional Strategies

Of all the animals on the sheet, can you find any that seem to be staying away from other kinds?

Try getting them together to see if they separate again.

THE OLD WHITE SHEET TRICK
Action Card #10

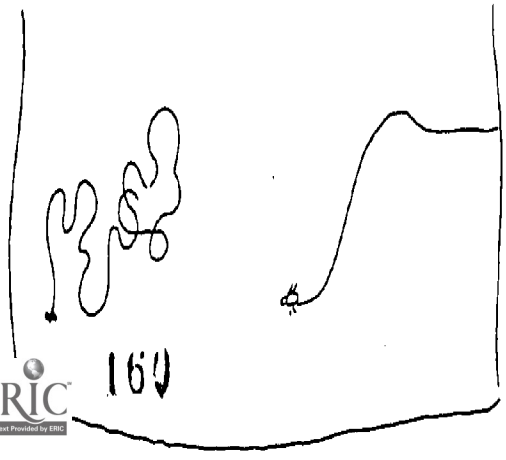
Outdoor Biology Instructional Strategies

Catch several nighttime animals and keep them in a ventilated container until morning. How do they act when released in the light?

THE OLD WHITE SHEET TRICK
Action Card #11

Outdoor Biology Instructional Strategies

Use a marking pen to trace the path of a walking animal as it moves around the sheet. Have an animal art contest.



THE OLD WHITE SHEET TRICK
Action Card #12

Outdoor Biology Instructional Strategies

Turn the light off for the length of time it takes you to count to ten. Then turn it on. What do the animals do?

Try longer and shorter counts to see how long it takes for the animals to go away.

FOLLOW THROUGH

☐ Compare animals that do not come to the light with those who do by using sweepnets to collect animals from the grass, field, and bushes. Then take the collected animals to the white sheet area and compare them to the animals attracted to the light. Are non-attracted animals bigger, longer, of a different color, lacking wings or eyes? Do they have fewer legs?

☐ Catch some spiders or other known predators of insects. Bring them to the area below the sheet and see which animals they hunt, how they capture, and how many animals they eat. (Warn the children to be careful of any that might harm them.)

☐ Try the *Old White Sheet Trick* in a different location. How do the results differ?

WHAT TO DO NEXT

	Set
Animal Diversity	*II*
Attract a Fish	*II*
Who Goes There?	*II*

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Berkeley California

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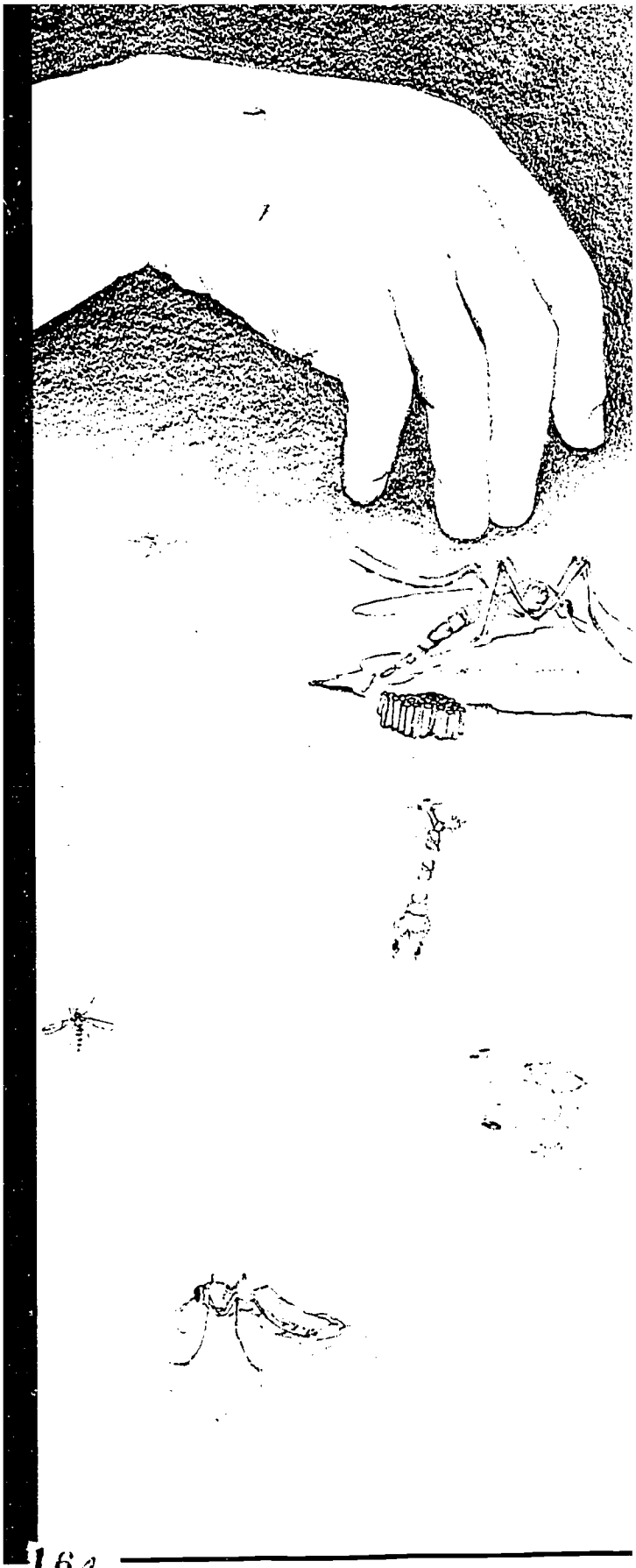
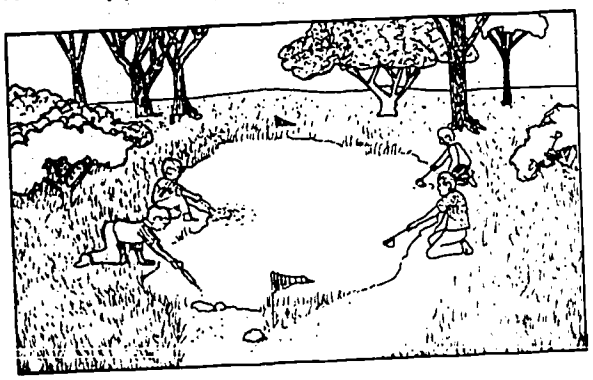


ACTION

1. At the activity site, briefly describe the mosquito's life cycle and outline the search for wiggler predators. (See SOLVING A PEST PROBLEM and CATCH THEM IN THE ACT sections.) Describe the two ways of investigating the problem.
2. Mark off two sections of the pond. One section is for the teams catching wiggler predators with nets and the other is for the teams using basters to add wigglers to the pond. Divide the group into buddy teams and assign each team to the appropriate section of the pond.



3. Distribute basters to the adding teams and nets to the catching teams. Hand out twelve wigglers (in small containers filled with pond water) to each team.
4. The teams can now search for wiggler predators. A team can switch its investigative approach by trading equipment with a team that is using the other approach, but each team should stick to its own section of the site.
5. Return all organisms to the pond at the end of the activity.

WHAT DO YOU THINK?

☐ After about thirty minutes, call the teams together to report their findings and make their mosquito control recommendations.
☐ Tell the group that the use of one organism to control another is called **biological control.**
☐ Tell the group that mosquitoes can fly two miles. Ask the teams what would happen if one town used control measures but the neighboring town (one mile away) did not. Would the pest problems be solved?
☐ Ask the kids for suggestions of biological controls for common household and garden pests, such as aphids, houseflies, adult mosquitoes, snails, slugs, or ants.

FURTHER INVESTIGATIONS

	Set
Attract a Fish	II
A Better Fly Trap	II
Food Chain Game	II
Adaptation – Predator-Prey	I

Outdoor Biology Instructional Strategies
Lawrence Hall of Science
University of California
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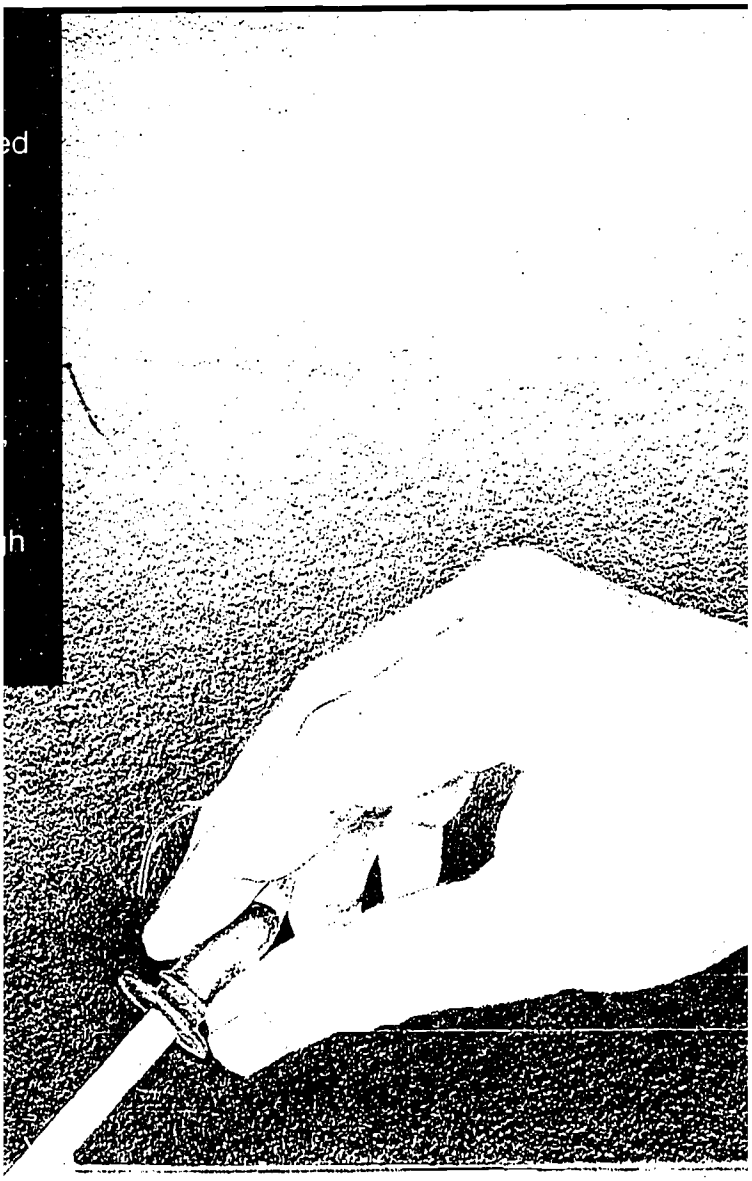

CURRENT THOUGHTS

☐ Which animals seem to breathe water, i.e., pump water in and out of their bodies?

☐ Do any of the animals take in or expel water from areas other than their mouths? Which animals? Where do these intakes and exhausts occur?

☐ How do the animals circulate water?

☐ How might movement help an animal survive? (Food, oxygen, warmth, protection, etc.). Tell the kids that special features of an organism (such as gills for breathing or a powerful tail for fast swimming) that improve its chances of survival and reproduction are called **adaptations.**

☐ What adaptations would you need to live underwater? (Mechanical devices such as scuba are not allowed.)

WHAT TO DO NEXT

	Set
Attract a Fish	II
Hopper Circus	II
A Better Fly Trap	II
Who Goes There?	I

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Jan. 1979 OBIS Equipment Order Form*

***About June, 1979, Delta Education, Box M, Nashua NH 03061 will distribute these and other OBIS materials. Contact them for prices and ordering information.**

Shipping Address (Please print):

Name: _____ **Date:** _____

Address: _____

City: _____ **State:** _____ **Zip:** _____

Please send me the following items in the quantities indicated:

QUANTITY	ITEM — DESCRIPTION		UNIT SHIPPING WT. (Kg.)	TOTAL WT. (Kg.)	UNIT PRICE	TOTAL PRICE
	Blacklight bulb for safari lamp	each	.05		$8.97	
	Blacklight fluorescent tracing powder	20 gr. pkg.	.10		.95	
	Blueprint paper (22 cm x 30 cm sheet)	25 sh. pkg	.20		1.75	
	Bug box	each	.01		.35	
	Colbat chloride crystals	110 gr. pkg.	.15		3.75	
	Colbalt chloride test paper (1 cm x 15 m roll)	each	.025		3.50	
	Colored cellophane (25 cm x 30 cm sheet)	red, each	.025		1.25	
		green, each	.025		1.25	
		blue, each	.025		1.25	
	Confectioners dye (10 grams in vial)	each	.020		1.00	
	Kodak Studio Proof F paper (20 cm x 25 cm sheet)	10 sh. pkg	.15		2.75	
	Line level	each	.025		1.40	
	Litter Critter Wheels thermofax transparencies	1 set of 4 wheels	.050		.35	
	Magnifying lens (3 lenses 3x, 5x, 8x, plastic frame)	each	.025		1.00	
	Meter tape	each	.025		.50	
	Ozalid paper (21.5 cm x 28 cm sheet)	25 sh. pkg	.15		1.00	
	Plastic measuring cup (250 ml)	each	.020		.30	
	Plastic vials with lid (14 dram)	pkg. of 10	.150		1.30	
	Spring scale (2000 gram)	each	.07		3.00	
	Thermometer, calibrated in °C	each	.025		1.25	
	Tweezers	each	.1		.25	
	Water Breathers dropper	each	.010		.25	
	OBIS Lawn Guide	each	.05		.60	
	OBIS Pond Guide	each	.05		.60	
	OBIS Trial Edition, Set I	each	1.20		8.50	
	OBIS Trial Edition, Set II	each	1.20		9.50	
	OBIS Trial Edition, Set III	each	1.20		10.50	
	OBIS Trial Edition, Set IV	each	1.20		11.50	
	The OBIS Trail Module	each	.05		2.00	

	Subtotal Wt. (Kg.)	**Subtotal**
	California sales tax for California residents only: (6% California residents) (6½% Bart County residents)	
	Shipping fee (see reverse)	
		TOTAL DUE

☐ Check or money order enclosed.
Make check payable to:
Regents of the University of California

☐ Please bill me. (Minimum order: $10.00)

SEND YOUR ORDER TO: Discovery Corner — OBIS
Lawrence Hall of Science
University of California
Berkeley, California 94720

☐ Please check here if you desire air mail shipment.
OTHERWISE ALLOW FOUR WEEKS FOR DELIVER
(Air mail takes approximately one week.)

PLEASE RECHECK YOUR COMPUTATIONS AND BE SURE THAT THE SHIPPING FEE IS CORRECT.

To Determine Your Shipping Fee:

1. Total the weight of merchandise.
2. Use Table A to find your shipping zone.
3. If you desire surface shipment, find the shipping charge in Table B. Allow at least four weeks for delivery.
4. If you prefer faster (1 week or less) airmail shipment, check the box on the front of this form, and find the shipping fee in Table C.
5. Enter the shipping fee in the appropriate box on the front of this form.

Table A — Shipping Zone

Zip Code Prefixes	Zone	Zip Code Prefixes	Zone	Zip Code Prefixes	Zone	Zip Code Prefixes	Zone	Zip Code Prefixes	Zone	Zip Code Prefixes	Zone
006-098	8	530-534	8	674-679	6	770-787	7	850-859	5	955	3
		535-540	7	680-681	7	788	6	860-864	4	956-959	2
100-199	8	541-543	8	683-693	6	789	7	865-880	5	960-961	3
		544-567	7			790-797	6	881 882	6	962-966	1
200-299	8	570-577	6	700-704	8	798-799	5	883	5	967-969	8
		580-582	7	705-706	7			884	6	970-974	4
300-379	8	583-588	6	707-708	8	800-826	5	890 893	4	975-976	3
380-381	7	590-591	5	710-729	7	827	6	894-897	3	977-979	4
382-385	8	592-593	6	730-739	6	828-832	5	898-899	4	980-985	5
386-387	7	594-599	5	740-745	7	833	4			986	4
388-399	8			746	6	834-835	5	900-928	4	987-992	5
		600-609	8	747	7	836-837	4	930-935	3	993	4
400-499	8	610-617	7	748	6	838	5	936-939	2	994	5
		618-619	8	749-762	7	840-844	4	940-951	1	995-997	8
500-508	7	620-667	7	763-764	6	845	5	952-953	2	998	7
510-511	6	668-672	6	765-767	7	846-847	4	954	1	999	6
512-528	7	673	7	768-769	6						

Table B — Surface Shipment

WEIGHT UP TO:		.5 Kg.	1 Kg.	2 Kg.	4 Kg.	6 Kg.	8 Kg.	10 Kg.	12 Kg.	14 Kg.
YOUR ZONE	1-3	1.50	1.50	1.50	1.75	2.00	2.25	2.50	2.75	3.00
	4-6	1.50	1.50	1.75	2.25	2.75	3.25	4.00	4.50	4.75
	7-8	1.75	2.00	2.50	3.25	4.50	5.50	6.50	7.75	8.75
WEIGHT UP TO:		**16 Kg.**	**18 Kg.**	**20 Kg.**	**22 Kg.**	**24 Kg.**	**26 Kg.**	**28 Kg.**	**30 Kg.**	
YOUR ZONE	1-3	3.25	3.50	4.00	4.25	4.50	5.00	5.50	6.00	
	4-6	5.50	6.00	6.50	7.25	7.25	8.00	8.50	8 75	
	7-8	10.00	11.00	12.00	13.00	14.00	15.00	16.50	17.25	

Table C — Air Mail Shipment

WEIGHT UP TO:		.5 Kg.	1 Kg.	2 Kg.	3 Kg.	4 Kg.	6 Kg.	8 Kg.	10 Kg.	12 Kg.
ZONE	1-3	2.25	2.50	3.25	4.00	5.00	6.50	8.00	10.25	11.00
	4	2.25	2.50	3.25	4.00	5.00	6.50	8.00	10.25	11.00
	5	2.25	2.50	3.25	4.00	5.00	6.50	8.00	10.25	12.00
	6	2.50	3.00	3.75	4.50	5.75	7.75	10.75	11.75	14.00
	7	2.50	3.00	3.75	4.50	5.75	7.75	10.75	13.00	15.00
	8	2.75	3.25	4.25	5.25	7.25	9.00	12.00	14.25	17.00
WEIGHT UP TO:		**14 Kg.**	**16 Kg.**	**18 Kg.**	**20 Kg.**	**22 Kg.**	**24 Kg.**	**26 Kg.**	**28 Kg.**	**30 Kg.**
ZONE	1-3	13.25	15.25	17.00	19.00	21.00	21.00	25.00	27.00	29.00
	4	13.25	15.25	17.00	19.00	21.00	22.00	27.00	27.00	29.00
	5	13.25	15.25	19.00	20.00	22.00	24.00	29.00	30.00	31.00
	6	16.00	19.00	22.00	22.00	25.00	27.00	30.00	32.00	34.00
	7	16.00	20.00	24.00	25.00	28.00	30.00	33.00	35.00	38.00
	8	20.00	22.00	26.00	27.00	31.00	33.00	37.00	43.00	44.00

OBIS ABSTRACT

What is OBIS?

Start with a group of young people in the out-of-doors and a biological concept or process as the basic ingredients. Add a large measure of fun; stir in the discovery approach; and season with a simulation, a game, a craft, or an interesting investigation. Mix thoroughly and you have one of the 100 activities that have been developed by the Outdoor Biology Instructional Strategies (OBIS) Project.

OBIS provides community-sponsored youth organizations and schools with learning activities for use at common outdoor sites such as lawns, local parks, city lots, neighborhood streams and ponds, and the seashore. Although the activities are intended primarily for ten- to fifteen-year-old youngsters, both younger and older people (including family groups) have enjoyed OBIS activites. Their easy-to-follow format, simple preparation and equipment, and short duration (usually one hour) make OBIS activities suitable for both the experienced outdoor-education leader and the first timer with no previous experience in biology. The activities may be used independently or sequenced to create a program to suit your needs. Scouts, Park and Recreation districts, religious groups, service groups, nature centers, summer camps, and schools are a few of the groups that have used OBIS activites in their outdoor-education programs. OBIS activities help youngsters and adults to better understand and appreciate the ecological relationships in their local environment.

How Were OBIS Activities Developed and Trial Tested?

The OBIS materials were developed at the Lawrence Hall of Science, University of California, Berkeley, and supported by a grant from the National Science Foundation. The materials were developed over a six-year period ending in 1978. Unlike many development projects, OBIS considered the testing of activities with youngsters to be an integral part of the development process. The OBIS activity development procedure is one of devising a strategy, trying it out numerous times with youngsters, making modifications and then retrying the revised activity. This testing,

revision, and retesting process was repeated on a local level and, in many cases, on a national level for each OBIS activity. To help gather national feedback on the trial edition activities, OBIS established a network of OBIS Resource Centers across the country. Over the past five years, OBIS has received thousands of feedback comments from OBIS users throughout the United States. This feedback is being used to revise the existing OBIS trial editions.

The OBIS Trial Editions are available through the Lawrence Hall of Science, University of California, Berkeley, California 94720.